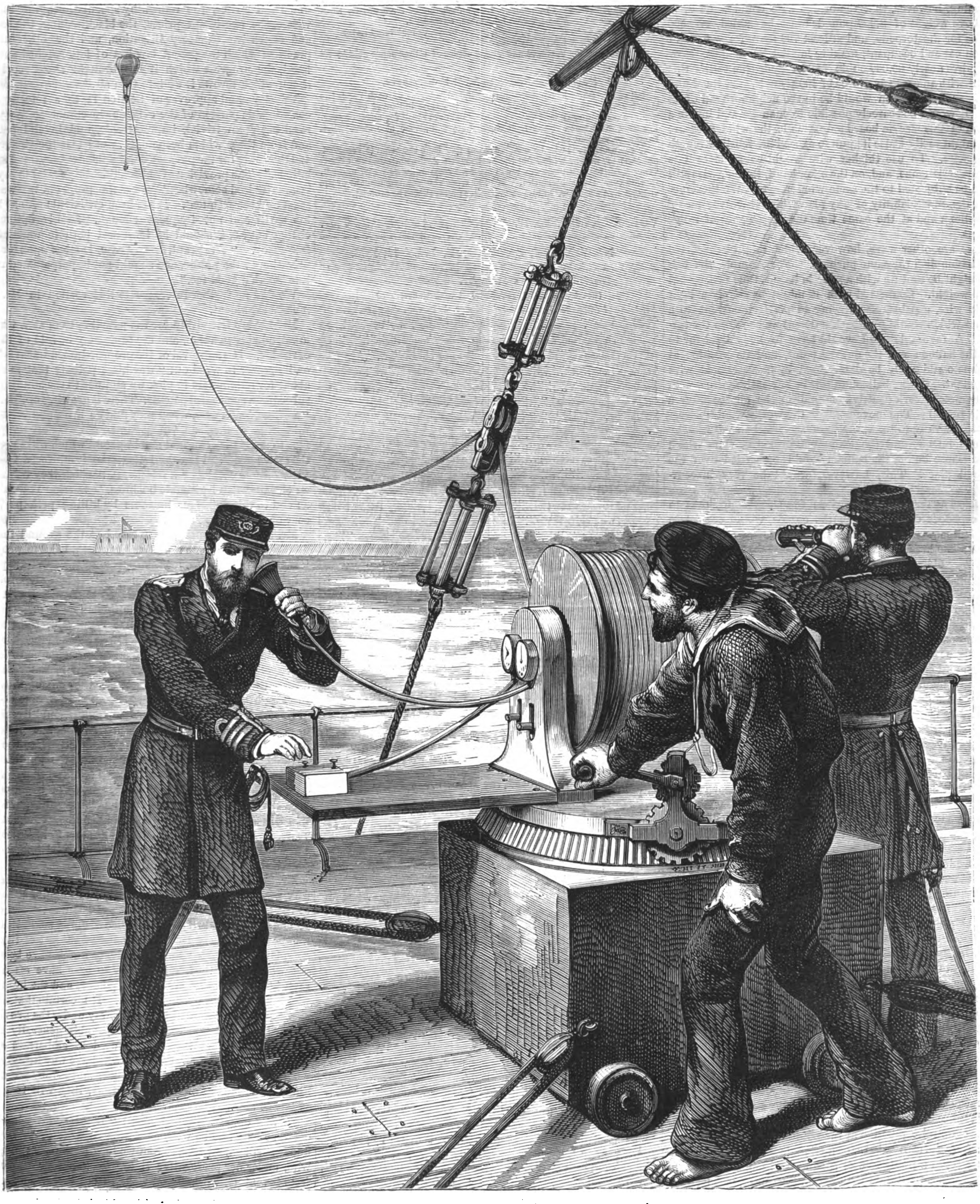
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 19. [NEW SERIES.] NEW YORK, MAY 11, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

AERIAL WARFARE.

The idea first published in these columns of dropping torpedoes into an enemy's camp or cities from balloons seems in a fair way to be put in practical shape abroad. The London *Graphic* publishes the large engraving given herewith, showing how a balloon carrying a large torpedo could be sent over a hostile fort from on shipboard. Our cotemporary proposes that gunboats shall be provided with balloons large enough to carry one man and the can of nitro-glycerin or other powerful explosive suspended at considerable distance below the car To the latter is attached a rope or wire, which is rove through a fair-leader and taken to the winch shown on the poop of vessel. The length of wire paid out as the balloon moves over the point to be attacked is indicated by dials on the side of the winch drum, and by means of a telephone the officer directing operations communicates with the occupant of the car, and receives from him directions when to slacken or reel in the wire. The



THE BALLOON TORPEDO.

vessel lies out of range of the fort's guns, and the balloon is allowed to ascend to a thousand feet or so before dropping its torpedo.

We are inclined to think that a good many practical difficulties would oppose themselves to the *Graphic* scheme, mostly arising from the necessity of keeping the balloon captive. The strain on a wire nearly six miles long would be great, and the weight of the wire would be a heavy load for a balloon to carry. The wire, besides the strain of its own weight, would be subjected to the pull of the balloon, which would vary in intensity according to the force of the wind. It probably would be necessary to employ steel wire at least as large as that used in the East River Bridge construction, which is capable of withstanding some 4,000 pounds tensile strain. Six miles of wire would be scant allowance to enable a vessel to keep out of range of improved modern rifled guns, and this quantity of the wire mentioned would weigh nearly 2,900 pounds. It might easily be imagined that the strain added, when the balloon is hauled in against its own ascensive power and against the wind, might increase the stress above the breaking point, and therefore still thicker wire or wire rope weighing still heavier might be needed. Assuming, however, that the bridge wire could be used, to the above weight of 2,900 pounds must be added, say, 500 pounds for the torpedo, and at least 700 more for weight of balloon car and occupant, making in all 4,100 pounds. Now it requires nearly 60,000 cubic feet of hydrogen to lift this weight with an ascensive force of 100 pounds, and the diameter of such a balloon would be in the neighborhood of 48 feet. It would be scarcely possible to manage and inflate a balloon of this size on board ship, while the wind pressure on it might easily cause its pull to exceed the tensile strength of the wire. To use thicker wire would be to necessitate still larger balloons, and, on the other hand, thinner wire still would be subjected to the same wind stress. We therefore doubt the practicability of any plan which involves a captive balloon and at the same time the keeping out of range of guns.

There are other ways, however, which might be resorted to to accomplish the same purpose. For example, the balloon might be sent up with no one in its car, thus saving that much weight. Connected with it might be simply a light double wire, capable of carrying an electric current to a magnet which would pull back a detent and so drop the torpedo. A favorable wind would have to be waited for to waft the balloon over the desired point, and its position at any time could easily be determined by measurement with the sextant. Or the balloon might be left entirely free, with simply a clockwork contrivance to drop the charge after a certain period. The movement of the works would be regulated according to the strength of the wind as indicated by the anemometer, and the estimated period of time which would elapse before the balloon would be carried over the required place. This, however, would be very inaccurate.

Defense against "dejectiles," as the *Graphic* proposes to call torpedoes dropped from the clouds, would consist in other balloons sent up to wage warfare aloft, or the invention of some kind of gun would be needed that would throw shells long distances at high elevations with accuracy. The projectile to use against torpedo balloons would be a shrapnel filled with explosive bullets, which, when the bomb burst, would be projected over a wide sphere. One bullet of this kind striking a gas bag would blow it up, and make it drop its charge where not intended by the enemy. Rockets would probably be revived again as defensive means against balloons, and doubtless would prove very useful. Of course, however, the main object would be to explode the torpedo in the air and some time before it could reach the ground and do damage, and over this problem we leave inventors to exercise their ingenuity.

As we have already taken occasion to point out, we think that if aerial torpedoes do become a seriously offensive means of warfare, it will be by the aid of the flying machine. Mechanical flight is not impossible, and all the means are at hand, requiring only ingenuity to adapt them to one another to insure success. The principles of flight are well understood, and it is possible to build light motors using electricity or even steam, which will keep an aerial ship aloft. This is the more important question bearing on future warfare. An easily managed and guided swift aerial ship carrying nitroglycerin torpedoes would be a terrible enemy.

Experiments with Floating Magnets.

Professor A. M. Mayer describes, in the *American Journal of Science and Arts*, some entertaining and easily performed experiments in magnetism. Several sewing needles, of No. 5 or 6 size, are magnetized with the same polarity, so that all their points are N. Each needle is passed into a small cork that will just float it upright; the corks may be ¼ inch long and $\frac{3}{16}$ inch across. The eye of the needle should barely be above the surface of the cork. Three, four or more of these needles are thus to be floated in a basin of water and the N. pole of a large cylindrical magnet is to be brought down over them. They will immediately take geometrical positions, the figure formed being smallest when the magnet above is brought most closely to them. Three needles thus take position at the points of an equilateral triangle; four form a square, or a triangle with one in the center; five form a pentagon, or a square with one in the center; six form a pentagon with one in the center, or a triangle of two to a side. Professor Mayer has obtained regular figures up to a combination of twenty needles.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

VOL. XXXVIII., No. 19. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, MAY 11, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 128,

For the Week ending May 11, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

ARGUMENTS FOR SECTION 11.

The proposed assimilation of our patent law to that of Great Britain, in the matter of periodical fees, was discussed before the House Committee on Patent Amendments by Messrs. Raymond, Christy, Storrow, Foote, and Smith. All but Judge Foote were decidedly in favor of the scheme; and we may fairly assume that they offered the strongest arguments they could command to sustain their position.

Mr. Raymond stood alone in his sweeping denunciation of the present working of the patent laws. He was not opposed to a wise patent system; for "a wise patent system does encourage inventions, and therefore promote public progress in science and the useful arts." But the working of our system during the past seventeen years has been the reverse of wise. Indeed, the law as it stands is, he said, so defective, and open to so many abuses, that he unhesitatingly and confidently asserted that "that part of the progress of recent years, during which the genius of the people has been exclusively directed to the arts of peace, which is directly the result of the patent system which has obtained during the same period, when put into the scales with the tax, the annoyance, the burden, the 'scare-crowing' of capital, the unnatural strifes, the unhealthy speculations, the inflated values, the exorbitant prices, the blackmailing, the tedious and expensive chancery litigation, and the other unholy practices which the patent law has of late hatched and fostered, the progress which it has brought about receives a shock which throws it up into thin air."

Mr. Raymond approves of Section 11 as a remedy for a considerable portion of the evils above enumerated—"evils resulting from trivial, impracticable, and invalid patents, and from those which become of value late in their existence, and then only for the purpose of infringement suits and speculations." The provision of this section, he goes on to say, has been criticised somewhat because the proposed tax was too great and too frequent. It has been criticised more as being too small and not frequent enough. In his opinion, if changed at all, it should be increased both in amount and frequency. "The grant, in any case, is a tax upon or a deprivation to the public, and should not be perpetuated unless it is worth a good fee."

We find no further reference to this section in Mr. Raymond's argument.

Mr. Hyde's friendship for the patent system as a whole is unmistakably genuine, and the same may be said of the rest of the list. His approval of the proposed amendment is based on its power to weed out "worthless patents that are lying about for speculators to pick up and use to the annoyance of subsequent successful patents. There is growing up," he says, "a class of men who, when they find an invention in successful use, go to the Patent Office and rake over all the patent files to see if they can find an old patent which will supersede the later successful one, and then buy it up for a nominal sum. After obtaining a reissue, if needed, they commence an onslaught on legitimate business." Section 11 would put an end to this nefarious business by killing perhaps 75 per cent of the patents issued.

Mr. Storrow's approval was based on the ground that undeveloped patents are a hinderance, not a help to progress. "If the invention at once takes place in the arts as a practical thing, or if it so clearly embodies a great step forward that the inventor or others are incited to develop it to a practical and pecuniarily profitable application, it constitutes a progress, and the purpose of the law is satisfied. But features are often patented which are afterwards found neither to be useful nor to hold out hopes of usefulness enough to lead to attempts to improve them. A subsequent inventor making a truly useful machine unconsciously uses one of those features and the patent stops him; it does not promote the progress of the useful arts that such a patent should live merely to hinder and not to constitute progress." The periodical fees will weed out such undeveloped inventions, to the great advantage of meritorious inventors and to the public. The result of a severer provision in England, Mr. Storrow goes on to say, "has been that the average life of a patent has been shortened from fourteen to about four years; we think that this section will shorten it from seventeen to about eight years, and it will not diminish the stimulus to invention, because it will only cut off those which after trial have been practically abandoned as worthless."

Mr. Smith thought that under the operation of this section fifty per cent of the patents granted would expire at the end of the first period and half of the remainder at the end of the second period, and thus their chance of doing mischief under reissues would be ended. "It has been a subject of frequent complaint," he said, "that old patents which have been idle and worthless in the hands of their owners have often been revived so as to cover subsequent patents and the industries which have grown up under them. It is certain that a large part of such patents will be swept away under the provisions of this bill. The fees will become payable generally before it is discovered that they can be used to embarrass subsequent inventors or manufacturers who have unwittingly used what might be covered by the reissues; and as they are worthless for legitimate purposes at the time, they will to a large extent be allowed to expire."

Further on, Mr. Hubbell asked: "If this country has prospered so long and so well, as compared with other nations, under small patent fees, so that we have superseded England, who, under her prerogative right, has taken excessive fees from inventors, why do you want to crush down inventors by exacting fees that will put them in the same condition as they are in England?"

Mr. Smith's reply was that it was for the interest of inventors that worthless patents should be put out of the way. "It is important that inventors should have the opportunity to protect their inventions if they think them worth protecting. If they do not deem them worth preserving, it is important that they should not stand in the way of other inventors, and the requirement of a small fee after the lapse of a few years will make it necessary for the owner of a patent to decide for himself whether he thinks it is worth preserving, and, if it is, the profits of the patent will enable him to pay it."

Judge Foote's objection to periodical fees arose from the simple fact that the Patent Office fees were already unnecessarily high. The office is now accumulating one hundred thousand dollars a year over and above its expenses; and if the object is to encourage invention, the fee should be made as light as possible. He preferred the issuing of a preliminary patent, at a low fee, to run three or four years, and a completed patent on the invention, as perfected, at the end of that time, should the inventor choose to apply for one.

We have recited the arguments of these gentlemen at length and with many repetitions, that our readers may see how few they really are. Boiled down, they amount to these two, and no more: 1st. Speculators have bought up and misused neglected patents. 2d. Inventors have been inconvenienced by pre-existing patents; in other words, they have been barred the free use of devices they wanted, or have been made to pay for such use, owing to the inconvenient fact that some one had patented the thing before they thought of it. Let these arguments be granted their fullest weight. Admit that designing speculators have been able to buy up and do mischief with rights apparently abandoned by the original patentees. Admit that inventors, as well as manufacturers, have found it unpleasant to have to pay for or let alone the fruits of other men's brains. Shall we, therefore, subject the entire class of inventors to charges not needed for the support of the Patent Office? Shall we open the door to gross injustice to worthy inventors of limited means, as shown in our issue of March 16? Shall we emasculate our patent system, as shown in our issue of April 13? In short, shall we punish the deserving many that we may forestall the wicked designs of a few?

It seems to us that the attempted justification of this Section 11, as a matter of policy even, hinges on the two assumptions that all patents not speedily developed are worthless, and that four or five years, or even ten years, are sufficient in every case to develop the value of an invention and bring it into profitable use if it is worth using—assumptions by no means justified by the history of great inventions, as we propose to show at length hereafter.

A NATIONAL SANITARY PRECAUTION.

A sanitary measure of more than ordinary importance, not only to the Southern seaboard States but to the country at large, has recently been passed in the form of a bill to be known as the "National Quarantine Act of 1878," the object of which shall be, by means of an efficient, uniform, national system of quarantine, to prevent the introduction of contagious or infectious diseases into the United States. It is to be understood, however, that while it may assist, it shall in no wise interfere with, the present or future rules, regulations, or workings of any State or municipal boards of health. The diseases against which the provisions of this bill are more particularly designed to guard the people are those two scourges to humanity—Asiatic cholera and yellow fever—the ravages of which have frequently been so appalling. The hope that the measures proposed in this act—vigorously carried out, and aided by the coöperation of local State officials—may in time succeed in shutting out these two diseases from the country, is encouraged by the fact that science has conclusively demonstrated that both are of foreign origin, and that there is no place within the United States where they have been naturalized.

In Asiatic cholera we have a disease caused by the access to the alimentary canal of a specific form of organic poison, which is portable, communicable, and capable of reproducing itself in every body in which it obtains lodgment. It always has its origin in Hindostan; and whenever it appears outside of the limits of that country it is absolutely certain that is an exotic. It was in 1756 that the fact was first recognized that the disease is a periodically returning twelve-yearly epidemic, connected with the twelve-yearly Hindoo festivals at the great temples. The prevailing direction in which the epidemic always advances from its birthplace is to the West and North, always proceeding along the lines of the greatest and most rapid travel; and, at each periodical recurrence, extending its limits and spreading itself over an increase of territory. It made its first visit to the United States in 1832, starting from Quebec, where it had been introduced by ten or twelve Irish emigrant ships. From this time on, its periodical returns have been pretty uniform; and judging from the past, we should expect another outburst either during the present or next year.

In our next contest with the epidemic, our whole safety lies in efficient quarantine and thorough disinfection.

As of cholera, so we may say of yellow fever, it comes in every case from without; there is no spot in the United States where it is indigenous. Its birthplaces are the West Indies, the South American coast, and, possibly, Vera Cruz in Mexico. From these neighboring countries it invades, almost every summer, our sea-board cities, and occasionally produces a desolation such as words fail to describe. This disease made its first appearance in this country in 1668; and from that time down to 1877 it had visited us seven hundred and forty-one times, spread its ravages to two hundred and twenty-eight cities and towns, and extended to twenty-eight States of the Union, causing 65,311 deaths counted—besides the innumerable deaths of which no record was made. Of all these numerous appearances of the disease among us, 45 per cent are directly traceable to foreign origin.

In a commercial point of view, likewise, have the losses to the country been incalculable. In a memorial accompanying this bill, from a convention of representatives of the Southern seaport towns, held at Jacksonville, it is asserted that the losses produced by the epidemic which raged in the city of Savannah in 1876 amount to $5,800,000, or nearly one half the present value of the whole taxable real estate of the city. Multiplying this particular loss by the many similar ones occurring annually in our other cotton ports, the result will be found to be startling indeed.

Since, then, the fact is so well established that these two fearful diseases which carry such destruction to life and property in their trail are entirely of foreign origin; that they must cross oceans before they can obtain a lodgment on our shores; that they must be brought in ships, hidden in clothing, bedding or personal luggage, or actively at work on the systems of passengers, and they thus become a part and parcel of our commercial intercourse with other nations, surely Congress—which has authority to regulate this commerce—can, and probably will, with the earnest coöperation of local authorities, aided by the provisions of this bill, control the visits of these terrible concomitants of our foreign trade.

TEACHING SCIENCE.

Professor W. K. Clifford has recently published an essay on the teaching of science, reviewing Virchow's address on the same subject, delivered at the jubilee meeting of German naturalists and physicians last year. Professor Virchow's utterances have attracted marked attention, both on account of their forming one of a trio of reviews on the present state of science, the other contributors being Häckel and Nageli, and also on account of their dealing with many important questions which have long vexed the minds of unprejudiced thinkers.

Häckel devoted his discourse to the present position of the evolution theory, the evidence supporting it, and its bearing on morals, education, and mental science. Nageli followed with a discussion of the limits of natural knowledge, pointing out the restricted nature of our senses, and suggesting that, "if we will be satisfied with such kind of knowledge as we can get, we do really know something, and may come to know a great deal more." Lastly, Virchow dealt with the liberty of science in the modern state, and in that portion of his admirable address, on which Professor Clifford bases his equally admirable review, he referred to parts of the evolution theory which are not yet established scientific doctrines in the sense that they ought to be taught dogmatically in schools. Of these he specially named two —the spontaneous generation of living matter out of organic bodies, without the presence of previously living matter; and the descent of man from some non-human vertebrate animal. These, he said, are problems our solution of which we may consider never so probable, and that the evidence will shortly be forthcoming to establish the same; but we must not teach them as known and established scientific facts. We ought to say, "Do not take this for established truth, but be prepared to find it otherwise; only for the moment we are of opinion that it may be true."

Professor Clifford puts this doctrine before the world in its practical bearing by applying it at once to the broad question of what should be taught to children, and in so doing, as we have already intimated, we believe he enters upon a subject which has been a source of incalculable doubt and misgivings to thousands of earnest people. Some idea of the evolution theory is now possessed by every one of ordinary intelligence, and to have any reasonable idea of it is also to perceive its conflict with the Mosaic hypothesis. It is perfectly true that many anchoring their faith to the latter decline, as is their undoubted right, to think on the question of antagonism at all, or to countenance any discussion thereupon; but on the other hand, while they can thus escape the consequences of their own reasoning, it is manifestly impossible for them to check the reasoning process in others. A knowledge of the evolution theory must come from the teaching of any department of natural science. To teach it is likely to exhibit its antagonism to the opposing hypothesis, and to excite thought and question. The parent, firm in his own faith, may well gravely view the alternative of what appears to him the dangerous knowledge on the one hand, or the equally dangerous ignorance on the other, which confronts the child, and eagerly seeks the middle ground in which he may reach a decision satisfactory to his own conscience. It is just here that Virchow's doctrine is illusory, for it is easy to take refuge in his caution, not to teach any but known facts, to brush aside the whole question with the assertion that the evolution theory is only a probability, and hence not to be taught; but then the same reasoning must apply to the Mosaic theory, which is equally based on other than positive fact, and in brief, it might be added, to anything whatever resting on faith.

Where then is the safe middle ground? Our author believes in the rule, "Before teaching any doctrine wait until the nature of the evidence for it can be understood;" and it seems to us that there is a world of sound sense in this. Nine tenths of all human antagonism is based on misapprehension, and that between science and theology is the reverse of an exception to the rule. The well-meaning "family" periodicals which cater to the tastes of their readers by assaults on what they are pleased to call "Darwin's ape theory," are ingenious in devising new evidences of their misunderstanding of the subject, and misapplication of its deductions. Ignorance even more profound is equally manifested by those who mistake their own incompetency to comprehend the great doctrines underlying religious faith, for flaws in the doctrines themselves, and who glory in their supposed stand on that summit of logical absurdities, atheism. It may be laid down as an axiom that it is not that which we do not know that retards progress, but that which we half know; better ignorance than wrong ideas which lead to worse error. It is intelligent education which lies at the basis of prosperity. The gulls of such men as Keely owe their gullibility to insufficient knowledge, and the same may be said of every enthusiast who formulates wild theories from his own consciousness and spends life and money seeking the impossible. The duty of science is to establish facts. Any one may make his own deductions; no one is bound to accept those of others. Facts once rightly established remain; conclusions based on them are always shifting; and the latter can never be right unless based on a knowledge of all the former.

Professor Clifford's rule has the especial merit of working both ways. "Much education," he says, "is required to enable the learner really to estimate the evidence for the many-toed horse; much more is wanted for the clear comprehension of the evidence for the simpler brained man." This evidence cannot be taught until a late period in education, otherwise the learner's head is confused with abstractions, which prevent his learning properly in the future. Finally, the writer elsewhere continues, "Teach your children to do good, and to eschew evil; if in later life they can find hope of an eternity of such action it will make them happier, and may make them better. But the experience of centuries condemns the practice of teaching the doctrine (of immortality) to little children, so as to make it familiar as an ill-understood conception, to weaken the power it might have for good, and to help the perversion of it to superstitious uses."

A READY MEANS OF ESTIMATING THE VALUABLE CONSTITUENTS OF CEREALS, ETC.

By means of a very ingenious method, first discovered by Mr. A. A. Hayes, of Roxbury, and Dr. Chas. T. Jackson, of Boston, it will be found that if a kernel of corn be split longitudinally, and immersed in an aqueous solution of sulphate of copper, the germ, or "chit," only, becomes colored green, thereby beautifully defining the limits of the phosphates by the formation of phosphate of copper. The same process may be applied to all seeds (except those of an oily nature), tubers, roots, and stems of vegetables for defining the parts containing phosphoric acid.

If a kernel of corn be split open, as before described, and thrown into a solution of sulph-hydrate of ammonia, the "chit" will soon be changed to a dark olive color, which is due to a change of the salts of iron in the seed to a sulphuret of that metal; a dark colored matter forming with the ammonia turns the vegetable coloring matter yellow, and the two colors combined produce an olive. Again, by taking split specimens of corn, or other grains, and soaking them in a tincture of iodine, the limits of the starch and dextrine will be distinctly defined—the iodine striking an intense blue with the starch, and a deep port wine red with the dextrine; so that, from this test, a rich violet (being the combination of the blue and red colors) will indicate the presence of both the starch and the dextrine in the grain. If the oil be extracted from the transparent horny part of the corn by means of alcohol or ether, the tincture of iodine will show the presence of starch in that part of the grain, associated with the gluten. By these means we may easily cause any of our cereal grains to represent to us the extent and precise limits of its phosphates, iron, dextrine, starch, and oil; and thus, by the eye alone, we may form an approximate estimate of the relative proportions of these ingredients.

Among other curious results of some experiments made by Dr. Jackson is the proof that the relative proportions of the phosphates in grain depend on the appropriating power of each species or variety; for, an ear of corn having been selected which had on it two different kinds, namely, the Tuscarora and a variety of sweet corn, and these seeds having been split and immersed in the same copper solution, soon gave evidence that there was more than double the amount of phosphates in the sweet than there was in the Tuscarora variety. Now since the kernels came from the same ear, and grew side by side, they obtained unequal amounts of phosphates from the same sap, derived from the same soil. A crop of sweet corn will take twice as much of the phosphates as the other variety, and consequently will sooner exhaust the soil of them.

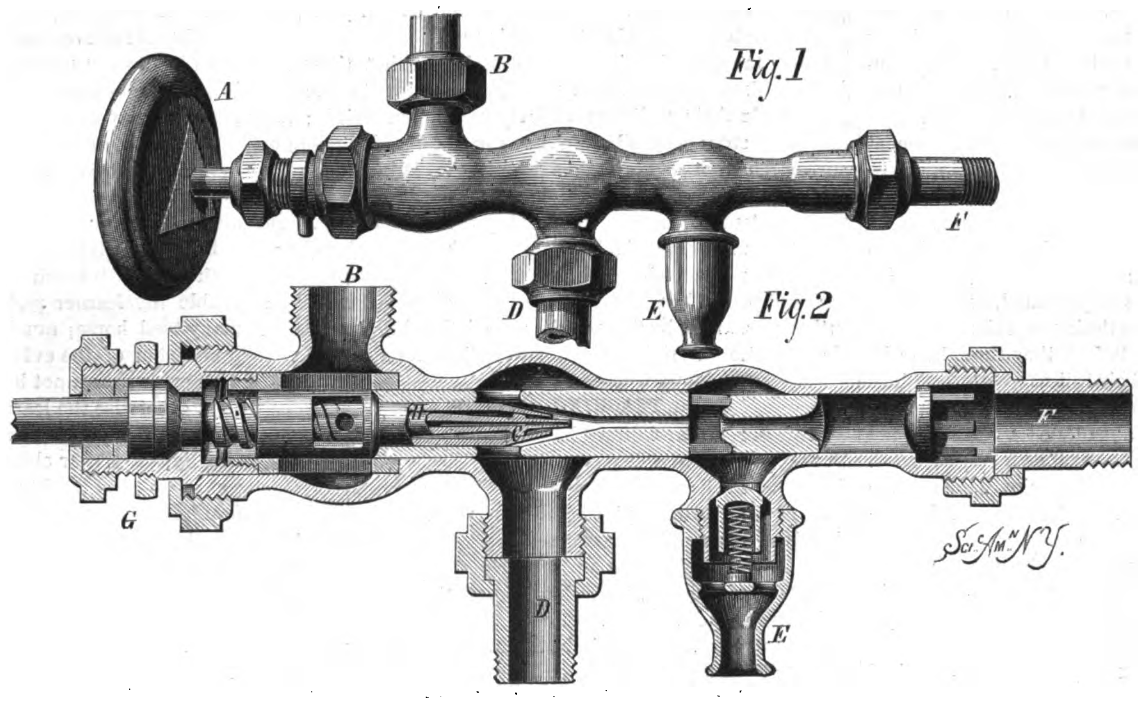
Some interesting facts were observed, too, in the variable proportions of phosphates in different varieties of the same species of other grains. The fact that the smaller grains, such as wheat, oats, and barley, contain so much less than Indian corn would seem to explain their peculiar properties as food for animals; the more highly phosphatic grain being more likely to surcharge the system of adult animals with the elements of bony matter, producing concretions of phosphate of lime, like those resulting from gout. Perhaps that stiffness of the joints and lameness of the feet common in horses fed too freely with corn may be accounted for by this preponderance of the phosphates. Young animals cannot fail to derive more osseous matter from corn than from other food,

THE ECLIPSE INJECTOR.

It is generally conceded that if an injector is so constructed as to work under a varying pressure of steam and water, it is the most economical mode of feeding a boiler, costing much less than a steam pump, and heating the water by the steam used for its operation. It is claimed that the Eclipse injector, illustrated herewith, meets these requirements. The engraving shows the exterior of the apparatus in Fig. 1, and a sectional view is given in Fig. 2. A is the regulating handle, B the steam inlet, C the steam plug, D the water entrance, E the overflow, in which is a valve, and at F is the boiler conduit, also provided with a check valve. By unscrewing the nut, G, the working parts can be taken out, examined, and replaced without any connections being broken or the injector removed from its position. This is an important desideratum, as the openings in an injector are so small that any particles of dirt or waste getting into it are liable to stop its working. The adjustment to suit different steam and water pressures is effected by the steam plug, C, which gradually regulates both the water and the steam.

When the steam pressure is high a large amount of water and a small amount of steam are admitted, and as the steam pressure falls, more steam is allowed to enter and the water supply is reduced at one operation, by simply turning the handle of the regulating valve, A. The injector is claimed to work equally well with a steam pressure of 1 lb. or 200 lbs., and will lift the water at any pressure. The apparatus is made with an internal jet, H. for lifting.

For further information and prices address R. W. Wilde, general agent, 108 Liberty street, New York city.



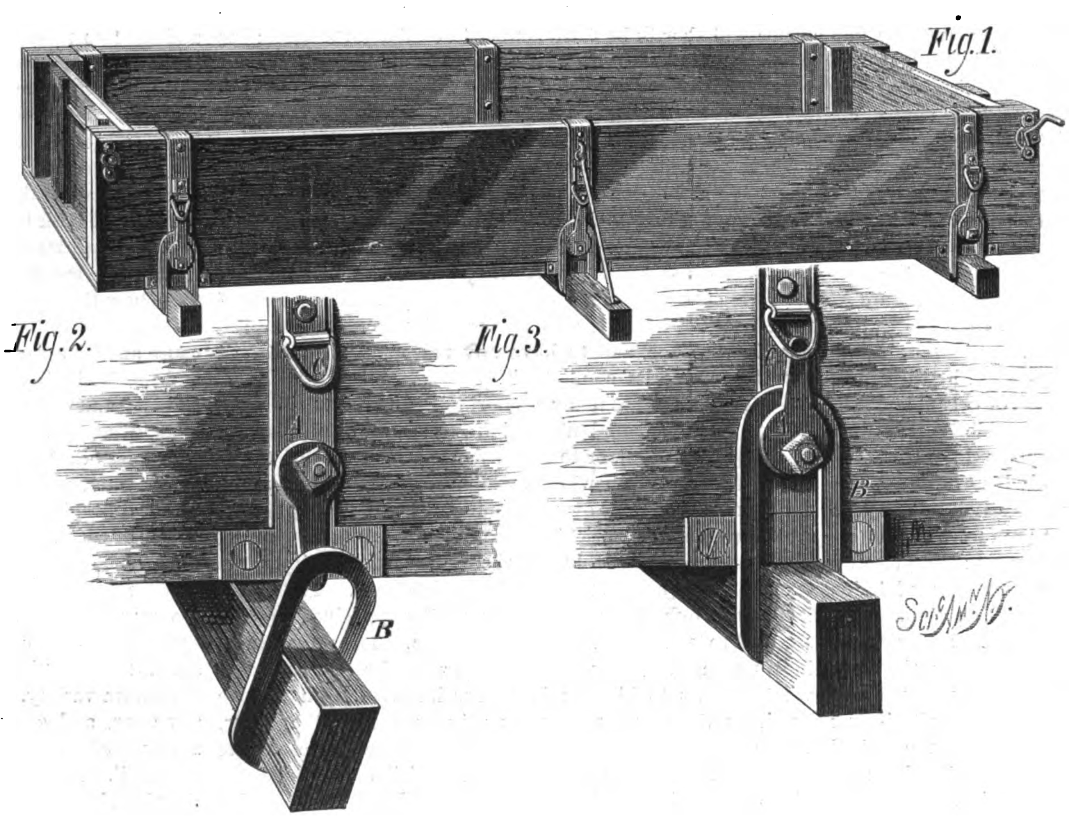
THE ECLIPSE INJECTOR.

IMPROVED WAGON BOX ADJUSTER AND FASTENINGS.

The annexed engravings represent a new and easily applicable device for quickly and tightly securing together the sides, bottom, and ends of the body or box of a wagon, so that the box may be made in separate pieces, which may be easily put together or taken apart when desired. The inventor claims that a box thus ironed can be put together or taken apart by one man in two minutes. No nuts or screws are used in working the device, and the entire device is attached to the box so that none of its parts are liable to be lost. It is easily applied without the aid of a blacksmith. Eccentrics, A, are pivoted to iron bands attached, as shown in Fig. 1, to the sideboards. These bands are strips of merchant iron, through which the necessary holes are punched, and are therefore inexpensive. The brace fits into a socket in the crossbar. B is a stirrup fitted in a groove or bearing on the under side of the ends of the bottom bar to prevent slipping, and in such a manner that it may be placed with its upper end over the eccentric. By turning the latter so that its long radius points upward, the bottom board becomes tightly secured to the lower edges of the sides. The eccentrics are secured in position by a ring, C, slipped over the end of the handle. Fig. 3 shows the contrivance locked, and Fig. 2 unfastened.

The device is exceedingly simple, saves time and labor, and is well adapted to the uses of farmers and teamsters generally. The box is held in place on the bolsters by cleats as usual.

Patented through the Scientific American Patent Agency, February 26, 1878. For further particulars address the inventor, Mr. C. G. Conkling, Lock Box 47, Harrisburg, Pa.



CONKLING'S WAGON BOX ADJUSTER AND FASTENINGS.

Embossed Silk Velvet.

We see in the *Moniteur des Fils et Tissus* that two inventions have been patented in France, the object of which is to produce a new effect by embossing a design upon velvet in one or more colors, differing from that of the piece or ribbon. Each invention has different methods. We first consider the invention of M. David. The piece to be operated upon is rolled upon a drum behind the machine, and falls in front into a box; during its passage the face is upwards, and goes under a glass rod, while the back passes over a small roller placed in a trough containing the mordant, or size, to be used; from this it passes again under a glass rod, and over a heated cylinder, which partly dries the mordant or size; it then goes over a paper bowl, and under a heated embossing roller, resting upon this latter, and thence into the box.

The pattern to be embossed is deeply engraved upon this roller, so that the pile of the velvet which passes into the sunken parts of the roller is unoperated upon, while the parts of the pattern where the pile is to be flattened are in relief on the roller. The color, or other substance, to be impressed on the velvet, is contained in a box provided with a roller, which, as usual in printing machines, deposits it rather thickly upon the parts of the roller which are in relief. If the color is crushed, or runs into the recessed parts of the pattern, it will be deposited upon the pile, but this does not matter, as it can easily be brushed off afterwards, for the color can only be fixed upon the piece where it is pressed into the pile, and the latter flattened, and thus comes in contact with the size, or mordant, penetrating from the back of the piece, and which also tends to keep the flattened pile permanently in position. The face of the raised parts on the roller is slightly fluted, the better to retain the color, and also to give to the parts which they flatten the appearance of a twill or any other design. It will thus be seen that where the roller is recessed the pile of the velvet forms a pattern in its natural condition, while the embossed parts, especially if done in colors, form, as it were, a ground of a different kind, by means of which very striking and pretty effects may be produced, the details of which may safely be left to the ingenuity and fancy of the printer.

Messrs. Vignets proceed somewhat differently. In this case the face of the velvet has a mordant or adhesive substance, such as gum, stearine, etc., applied to it, and the coloring matter in a powder, or flocks of any material from the shearing machine, silk waste ground fine, or any other substance, are then deposited upon it, and made to adhere by heating the fabric. The piece is then passed under an engraved roller as in the method just described, and the patterns thus embossed upon it. The parts of the pile which pass into the recesses on the roller remain standing, and by submitting these projecting parts to the action of brushes, the substance deposited upon them is removed, but remains in the depressed portions, and, as before, the printer can obtain results which, for variety and effect, admit of variation almost without limit.—*Textile Manufacturer.*

New Inventions.

A Feed Water Heater for steam boilers, invented by Mr. H. G. Cady, of Belleville, Ark., is simply a coiled pipe, upon which the fire impinges before entering the boiler flues, one end of the pipe being connected with the boiler at the water line, and the other, by means of an outside pipe and valve, with the cold water supply pump.

Mr. J. H. Wygant, of Hackensack, N. J., has patented an ingenious Wheeled Toy for children, in which springs, acted upon by crank pins on the axle, cause an alternate and rapid movement of two balls, which appear to be thrown by a figure.

Mr. W. T. Doremus, of New York city, has patented a new Sash Stop and Lock, which is so constructed that the sash cannot be raised without throwing the device into such a position that it will lock the sash automatically when lowered, and which may be locked in position when fastening the sash down, so that it cannot be unfastened from outside the window. It is an improvement on patents Nos. 189,088 and 199,194, issued to the same inventor.

Mr. F. A. Sawyer, of Houston, Texas, has improved upon a former patent issued to him for a Vapor Burner, by making alterations which permit ready adjustment of the size of the flame. An exterior tube, having a closed top, fits on the wick tube, and has a number of exit holes which register with corresponding slots in the wick tube. The outer tube is turned by a lever arm provided with stop devices, thus increasing the number of flame jets to six or more, or reducing it to a single jet when used as a night lamp.

Mr. John Kirkland, of Menomonee, Wis., has patented an improved Spark Arrester for Smoke Stacks, consisting of a series of inverted and perforated cones and a perforated cylinder, which form eddies into which the sparks fall and are consumed. The inventor claims that the draught is but slightly retarded by this arrangement.

Shelf Steps, or Brackets, of the form lately patented by Mr. J. C. Thomas, of Milroy, Ind., are applicable to use as step ladders, as brackets in show windows, or for the support of temporary shelving. A mortised upright carries a sliding and turning step, which is held in horizontal position, when drawn out, by a recessed shaft and casting, or in a vertical position when folded back into the mortise of the upright.

An Inhaling Apparatus, to be used for relieving throat and lung diseases, for the inhalation of the vapors of different medical substances, such as that of chloride of ammonia, for instance, has been invented by Dr. L. E. Felton, of Potsdam, N. Y. It is a convenient arrangement, and effectually prevents the escape of fumes when not in use, and of acid in case of tipping over.

Mr. Chas. Everts, of St. Louis, Mo., has patented an improved Washboard, made of sheet metal, and having transverse continuous ridges joined by intermediate longitudinal ridges at right angles, between which ridges are inclined rubbing surfaces and soap pockets.

Mr. T. W. Cardozo, of Brooklyn, N. Y., has patented an improved flexible and metallic Spring Pillow, which is claimed not to be liable to receive permanent indentation by compression, and to always resume its normal shape and size when left intact, without shaking or other manipulation.

Mr. B. F. Melton, of Gainesville, Texas, has made certain improvements in the construction of Saddles, of the kind known as Spanish, so as to make them simpler, stronger, and lighter. The weight of the Spanish saddle, as it is usually made, is the principal objection to its use; and this is what the inventor seeks to correct.

Mr. J. W. Cooper, of Salem, Ind., has invented an Alcohol Lamp, for use in soldering and similar purposes. The reservoir is pivoted in a supporting frame, and is provided with two wick tubes of different sizes, which latter have independent extinguishing devices. By an ingenious contrivance the wick of the larger tube is automatically projected and lighted by the smaller flame, which is kept burning, whenever the reservoir is turned on its pivot.

IMPROVED SAW MILL HEAD BLOCK.

We illustrate herewith an improved head block of new construction for saw mills. It is strongly made, and possesses novel modes of adjustably fastening the carriage to the

Fig. 1

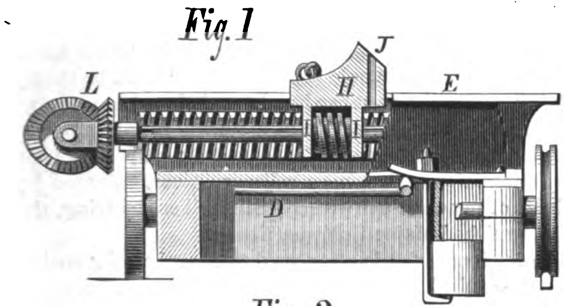
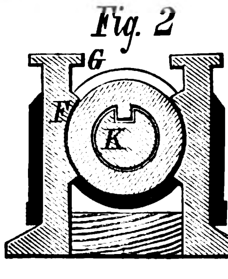


Fig. 2

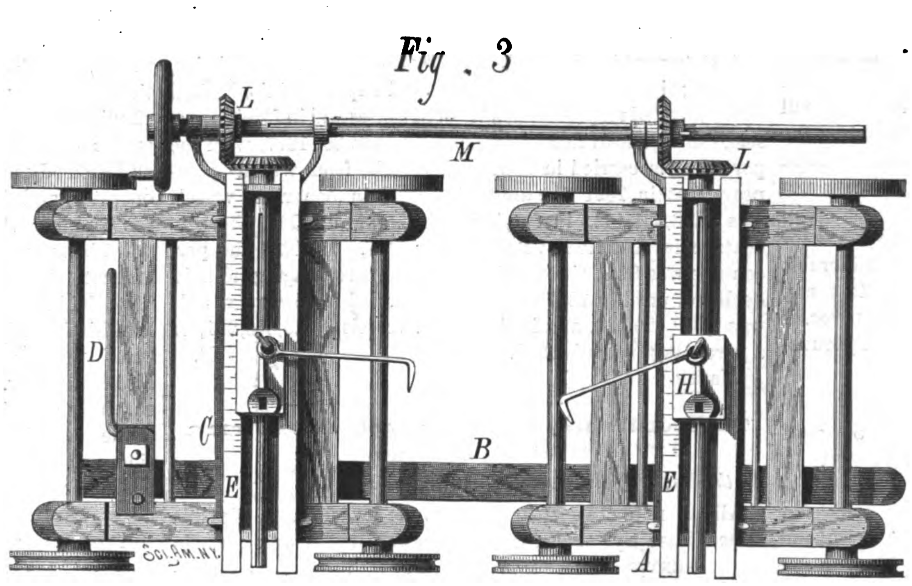


rock rail, and of holding the log and driving the dog into it. Details of the mechanism are shown in Figs. 1 and 2, and a plan view is given in Fig. 3. A is the head frame, which, in common with the other rectangular frame, C, shown, is supported by track wheels secured to axles. It is attached to a bar, B, which has a rack upon its under side that is engaged by the usual driving pinion. The frame, C, is movable on bar, B, being notched to receive the same, and has a clamping bolt that hooks under the bar and is secured by a nut resting on a plate on the top of the frame. An eccentric lever, D, is provided, by moving which the plate is raised, bringing the head of the bolt against the bar and so clamping bar and frame together. Upon each of the frames a head block, E, shown in section in Fig. 1, is placed. This consists of two similar iron parts separated by a block at each end and secured by bolts. In the inner face of each part is formed a screw rack, F, and a rib or guide, G. This guide is received in grooves in the knee, H, which is provided with ears, I, that project downward, and a short arm, J, that is apertured to receive a stake, and beveled downward toward the saw end of the head block, to adapt it to the surface of the larger logs. The knee also carries the usual log hook.

Between the ears, I, and upon a shaft, K, Fig. 2, a tubular screw is placed, which is kept from turning by a spline in the screw and a slot in the shaft. Upon the end of the latter bevel wheels, L, are placed, which may be rotated by similar wheels on the shaft, M, so as to carry both knees forward at once at the rate of an inch for each revolution of the hand wheel. When it is desired to increase or diminish the distance between the head blocks, the cam lever, D, is raised so as to release the bar from the clamping device, when the frame, C, will remain stationary while the frame, A, is moved in either direction, as may be required, the bevel wheel imparting motion to the parts on said frame being loose on the shaft, M. The knees are made shorter than those in common use, to admit of rolling a large log upon a short head block.

Patented through the Scientific American Patent Agency, March 5, 1878. For further particulars address the inventor, Mr. James S. Scofield, Little Sioux, Harrison county, Iowa.

Fig. 3



SCOFIELD'S SAW MILL HEAD BLOCK.

Solar Steam Power.

We recently mentioned the experiments of W. Adams, of Bombay, India, in boiling water by the heat of the sun. He has lately tried further experiments, as follows:

In the presence of several gentlemen of Bombay, 9 gallons of water were poured into a small boiler at 9:25 A.M. The rays of the sun were then directed on the boiler, and the water boiled in exactly 30 minutes. After boiling exactly one hour the focus was turned off, when it was found that 3¾ gallons had been evaporated. In the experiment described above, he used 198 glass mirrors, each 15 inches by 9½.

An Aerial Spy.

Mr. W. B. Woodbury has recently proposed an ingenious idea for taking photographs of an enemy's works from a balloon, without necessitating the presence of an aeronaut in the car. Electrical wires are run along the cable by which the air ship is held captive. Instead of a car a box is provided, inside of which another box is pivoted so that it will keep horizontal. In the inner box is the photographic apparatus, and over the lens is an ebonite shutter moved by the current, to open or shut instantaneously. There is also a sensitized tissue on rollers in rear of the lens, which is operated by clockwork, also controlled by the current. When the balloon is elevated to the required height, the lens properly focused and the tissue in position, the shutter is set in motion by the current, giving instantaneous exposure. A photograph is thus obtained, and by further controlling the clockwork fresh sensitized surface may be exposed and additional images taken.

Foreign Markets for American Goods.

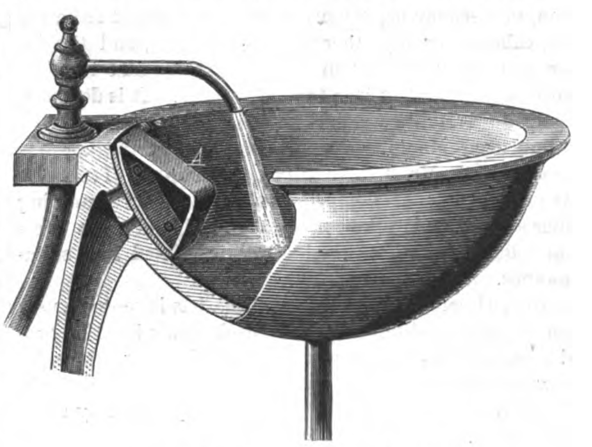
Thanks to the genius of American inventors our manufacturers are now able to compete successfully with the most skillful of other nations, not merely in our home markets, but abroad, in many lines, even at the very centers of corresponding foreign industry. But this victory of mind over muscle has been so rapidly made that our commercial classes have not had time to adjust themselves to the new conditions. Our merchants have been slow to appreciate the advantages of their position; and are but just discovering that the great markets of the world are open to them. A little prompt action now on their part would capture for American industry some of the most desirable of those markets, and give an impetus to our machinery beyond anything we have yet known.

Last summer Secretary Evarts sent to our Ministers and Consuls in various countries a circular of inquiry asking information in regard to the conditions of trade and the measures likely to promote the foreign commerce of the United States. The *Herald's* Washington correspondent has compiled from the replies to that circular a large number of interesting statements with regard to the foreign demand for American goods and the conditions which prevent our meeting such demands. The hinderances arise chiefly from our lack of shipping facilities and apparent indifference of our merchants to the special needs of the various countries we might send our goods to. Indeed the *Herald* goes so far as to say that the general impression which the reports leave on the reader is that we Americans have almost forgotten how to carry on a foreign trade. The general result of the inquiry is summed up as follows: "American manufactures are better in quality than those of any other nation, are highly appreciated almost everywhere, and are in the main as cheap or cheaper than any others. But the trade in them is pushed with but little skill and energy by our people; our exporters act carelessly and do not in such matters adapt themselves to the necessities of different countries as carefully as the English and Germans. Dealers abroad complain that descriptive circulars and price lists are not full enough. Our manufacturers do not adapt their goods to different markets as readily as do those of other countries, and communication with the United States is far slower and less certain than with Europe, even in the countries of South and Central America. But besides these general complaints there are two others which appear in almost all the reports, and which, the testimony shows, are vital. One is that our manufacturers and exporters do not maintain fixed prices, but vary them frequently, being compelled to this by the fact that we here are cursed with a currency of fluctuating value. European and South American dealers say that it is impossible for them to order American goods, even where these are greatly preferred and cheaper, because prices are thus unsettled. The other complaint lies against our high tariff, which disables us from buying and importing foreign products, and thus forces merchants abroad to trade with England, because the outward freight on their purchases is lessened by the fact that the ship is sure of a return freight to Europe."

GILBERT'S WASH BASIN VALVE.

We illustrate herewith a new valve for wash basins, by means of which the sewer pipe is claimed to be as effectually closed as the water pipe ordinarily is, and that consequently no sewer gas can escape into the room. The valve being air tight, a partial vacuum is produced above the water trap, which prevents the rush of water through waste pipes below siphoning the water out of the trap. The construction is also such that the valve cannot be left open when the water is turned off or left shut when the latter is turned on.

The valve is shown at A in our illustration, and is hinged to the rim of the basin. It is made hollow, and of such a weight that as the water rises in the basin it is raised, and the holes covered are so opened that the overflow water may



GILBERT'S WASH BASIN VALVE.

freely escape. The lower surface of the valve is covered with leather, rubber, or similar material, to cause it to cover the overflow holes tightly.

Patented through the Scientific American Patent Agency March 19, 1878. For further information, address the inventor, Mr. John S. Gilbert, 202 W. 14th street, New York city.

New Mechanical Inventions.

A new Cutting and Boring Attachment for Lathes has been patented by Mr. Mathew Rice, of Augusta, Ga. It is a hand appliance for shaping, moulding, polishing, etc., which is driven by band pulleys and held to the work by handles. The apparatus is adjustable to a variety of uses.

Mr. John Schofield, of Cheyenne, Wy. T., has patented a Flooring Clamp, consisting of a sliding presser, worked by a lever and ratchet gear, and mounted on a base plate which is securely fixed to the joist. The tool is applicable for clamping other work besides flooring.

A new Motor, invented by Mr. C. C. Gish, of Salem, Kan., consists of a heavily weighted chain wound on a chain wheel eccentrically, and operated by an engine, water wheel, or other power, the object being to utilize the weights on the chain as they descend.

In an improved Stamp Mill, invented by Mr. J. M. McFarland, of Virginia City, Nev., the essential features are the addition of auxiliary sliding tappets or weights, which are engaged by cams when the mill is run at a high velocity, thus adding to the impetus of the stroke; and the substitution of corrugated instead of plain screens, to increase their capacity for a given area.

An improved Bracket for Scaffolding, for use on shingled roofs, has been patented by Messrs. T. M. McClelland and J. A. Grant, of Mount Pleasant, Iowa. The bed plate ends in a chisel-shaped piece, which is driven under a shingle from below, and the butt of the shingle is held by a pivoted lever clamped by a screw. This gives a firm support for the scaffolding, additional brackets being used as required.

A convenient device for Lubricating Axles has been patented by Mr. L. H. Hinaman, of Long Eddy, N. Y. It is secured to the upper side of the axle, just within the collar, and by means of simple mechanism forces the oil out upon the axle arm when desired.

A Clothes Washing Machine, patented by Messrs. W. E. Armstrong and David Giesman, of Ludington, Mich., is of the class in which a reciprocating or pounding movement is employed. It has an ingenious arrangement of tubes and a rubber valve, by means of which air is forced through the clothes and water at the bottom of the machine, thus cleansing the clothes rapidly.

Mr. J. H. Herriff, of City Bluff, Mo., has patented a Car Coupling, in which the coupling link is secured in position over a retaining fin of the draw bar by means of a spring-acted hook, which is lifted by an angular lever and connecting rod when it is desired to uncouple the cars. The draw

bar is adjustable in height by being suspended by a chain and stirrup, which may be raised or lowered by turning a crank.

A novel construction of Railway Tracks, dispensing with wooden cross ties, has been proposed by Hermann A. Haarmann, of Osnabrück, Germany. A longitudinal box-shaped bearer with a broad base forms the support for the rail, which is secured to it by clamps and cross bolts. The bearer is supported on lateral iron cross ties, by means of side recesses and fastening bolts. The general idea is not new, but the details of construction and arrangement are original.

Mr. Samuel Arnold, of Silver Springs, Tenn., has patented a new Clothes Wringer which possesses several advantages. The rollers are of wood, faced with rubber, and the pressure is applied by means of wooden springs, which are formed into forks at each end and are capable of being reversed whenever they become set. The action of these springs is regulated by a convenient lever locking arrangement, adjustable as desired, so as to produce more or less pressure between the rollers.

An improved Car Brake has been patented by Mr. J. V. Ericson, of Escanawba, Mich. It can be operated from the engine, caboose, or any other part of the train, and the inventor claims that the system is less expensive and requires no more dead weight of iron than air brakes. It is designed especially for freight cars.

An improved Machine for making Cotton Batting has been invented by Mr. J. L. Norton, of Memphis, Tenn. It consists of a pair of compressing rolls, an accumulating cylinder around which the cotton is wound under the pressure of rollers, and a hot pressing roll, combined in a suitable manner.

Mr. John Hogan, of Fort Worth, Tex., has invented a new system of Car Coupling, in which each draw head is provided with both a hooked draw bar and a locking drop gate, the particular point covered by patent being the manner in which the draw bar is held in horizontal position by cushioning springs.

A Water Wheel invented by Mr. S. P. Mackey, of Brownsburg, Va., is in the form of a funnel, having a solid lower end with a socket at the bottom, and provided with buckets on its inclined sides, extending through about one quarter of the circumference. The inlet openings are on the inner surface of the sides of the wheel, and the outlet openings on the outer.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The order of the Commissioner of Patents to the examiners whose cases were behindhand to work until five o'clock is beginning to produce its effect, so that there will soon be much less time to wait before a case is acted on, and inventors will thus be able to know without much delay whether their hopes of obtaining a patent are well founded or not. As one effect of the order, it may be noted that the last issue of patents, that bearing date April 16, is the largest one issued in any week for two years. The following are the numbers of each class: 302 patents, 16 reissues, 18 designs, 88 trade marks, and 6 labels.

The owners of these patents and those of the previous week's issue will have to wait for them some time longer than is usual, on account of the failure of Congress to make any appropriation for the printing of the specifications. It is not yet known how long the patentees will have to wait, as that depends entirely upon the action of Congress in passing the deficiency bill, and there appears to be no disposition to hurry matters at the Capitol. This failure of the appropriation is going to cause considerable trouble, and will offset for the present to some extent the good effected by the Commissioner's order, because, although the patents will be numbered, dated, and signed, as the specifications are not printed, the patents cannot be sent out, and inventors will have to do as well as they can without their long wished-for documents. It will, no doubt, be a cause of considerable annoyance to many patentees, and of actual loss to some, especially in reissue cases. The Patent Office, however, is not to blame in the matter, but the short-sighted pseudo-economy of Congress.

"PROTECTION" TO CASTINGS.

The House Committee on Patents has agreed to report favorably Mr. Sayler's bill "for the security of property in metal castings." It provides that any person counterfeiting any registered metal casting by using it as a pattern in moulding, without first obtaining the written consent of the owner of the registration, shall be liable to the latter in the amount of the ordinary wholesale profit upon the articles produced; and any court of competent jurisdiction may order the delivery of such counterfeit castings to the complainant, or their destruction by the marshal. The requirements to those wishing their rights in their castings protected are these: First, such castings must have upon them the word "registered," together with the date of registration; second, the names of the parties requiring the protection must be recorded in the Patent Office, and a fee of $20 will have to be paid in the same manner and for the same purpose as the fee for a patent. The certificate of registration is to remain in force for 17 years. This is an iniquitous bill, inasmuch as it aims to empower the owner of a wooden pattern for an old stair plate, for example, which anybody can make for a dollar, the right to collect hundreds of dollars damages of any poor fellow who uses one of the cast plates for moulding.

TESTING TORPEDOES.

The House Committee on Naval Affairs has agreed to report a bill appropriating $250,000, to be expended in purchasing and testing the different styles of torpedoes known, with a view of reaching a conclusion as to the best and most suitable for use by the United States Navy.

PATENT REVENUE STAMPS.

It is reported that the Committee on Ways and Means are about to recommend a new system of collecting the revenue on cigars, said to have been patented by Mr. Chas. Ewing, the essential feature of which consists in putting a stamp on each cigar and another one on the box, those on the cigars having numbers to correspond with the number on the stamp. As every box stamp is to be furnished with a number distinct from all the other box stamps, a box that has been stamped and emptied cannot be used again without detection, as the numbers on the cigar stamps must correspond with the number of the box stamp.

IMPROVING THE MISSISSIPPI.

From reports lately received here, it appears that the channel at the South Pass is constantly deepening. From the head of the jetties to Section No. 105, a distance of 10,500 feet, there is now an open channel 250 feet wide and 24 feet deep. From that point to Section No 115, a distance of 1,500 feet, the channel is 140 feet wide and 24 feet deep; and from the last point, for a distance of 40 feet, the depth is 23 feet. The estimated amount of material to be removed in order to secure a channel 250 feet wide and 24 feet deep entirely through the Pass is 65,000 cubic feet, according to the latest surveys, which, it is thought by the government engineer, will be accomplished within the next sixty days.

The House Committee on the Mississippi Levees have agreed to report a bill authorizing the appointment of a commission to report upon the improvement of the levees from St. Louis to the mouth of the river, to consist of three army officers and three civilians. The bill appropriates $250,000 to defray the expenses of the surveys, the salaries of the officers, etc.

In this connection, it may be stated that Mr. M. J. Adams, of St. Paul, Minn., has lately been before the House Committee on Commerce, asking for an appropriation to test his invention for establishing permanent channels in rivers, which consists in a line of tubes laid in the bed of the river, provided with valves which open and close apertures through the tubes. Water is forced into the tube by a pump at the head, and a gate at the other end secures the pressure. By opening the valves covering the apertures in the tubes at any desired place, the water rushes out with such great force as to thoroughly agitate the sand or mud in that neighborhood, keeping it in suspension until carried away by the current into deeper water.

HATCHING SHAD BY STEAM.

The new method of hatching shad, in which steam machinery plays an important part, to test which an appropriation was passed by Congress last December, gives promise of being successful. A station has been established on Albemarle Sound, nearly a million of young shad have been planted in Virginia and North Carolina waters, and the work is expected to be largely increased before the season's close. The Smithsonian authorities recently received information that shad had been caught at the Falls of the Ohio river, and also in the Coosa, in Alabama, which is believed to be the result of the operations of the Fish Commission.

THE DECLINE OF AMERICAN NAVIGATION.

A statement has been prepared by the Bureau of Statistics, showing the value of the imports and exports of the United States, carried respectively in United States and in foreign vessels, during the 57 fiscal years ending June 30, 1877, with the percentages carried in American vessels, from which it appears that in 1821 the amount carried in American vessels was $113,201,462, in foreign vessels $14,358,235, the percentage in American vessels being 88·7. In 1826 the percentage was 92·5, since which time the percentage gradually declined, until in 1877 the amount carried in foreign vessels was $859,920,536, and in American vessels $316,660,281, or a percentage of only 26·9. R.

Washington, D. C.

The Flexible Wheel Base for Cars.—Letter from a Veteran Inventor.

To the Editor of the Scientific American:

Allow me to suggest to you that the "Cleminson Flexible Wheel Base System" for railway cars, which you give in the SCIENTIFIC AMERICAN of the 13th inst., is identical, apparently, with that patented by the undersigned in this country in 1839 or thereabout,* and which was adopted and used on the old Catskill and Canajoharie Railway, N. Y., from that time until its failure and abandonment in 1840, and with the same satisfactory results, as the London *Engineer*, as quoted in your article, certifies for it, as used in England. The above railway was one well adapted to test the practicability of the plan, it being very tortuous, as located through the gorges of the Catskills, having one curve of less than 100 feet radius, and several from 400 to 1,000 feet radius. We tested them for lateral friction, and found, by indication on dynamometer, that, excepting at the instant of entering curve or tangent lines, the difference between them or curved and straight lines was of but slight amount. We found also that the wear and tear of this form of our rolling stock was very much reduced, and the repairs for the time used was as 4 to 10, being 60 per cent in favor of mine. I have the certificate of the acting directors and superintendent of repairs of the corporation to that effect, as I remember; but I have it not at hand, and may not be quite exact. Mr. Knowles, afterward actuary in your patent agency office, as I have been informed, assured me, when calling on him at the Patent Office at Washington—in 1840 or thereabout—that there was not a model of railroad machinery in the office more frequently called for for inspection than mine. So it would seem that there must be many still living who will remember it. I was induced to attempt the invention from the stimulus of a liberal reward offered by the Belgian Government in 1835 for the most perfect plan for obviating lateral friction on railway curves, enforced by the advice of my chief and preceptor in civil engineering, the late distinguished Major Ephraim Beach.

My professional friends all seemed to regard my invention as about theoretically perfect, and placed its prospective value at a high figure, so high as to quite puzzle me to determine what amount of good I could do with it, and I am still in doubt about it. There was one pretty serious objection to the plan, as operated on the wooden stringer and strap rail of those early days of our railway building; for although these cars of mine were not apt or liable to jump the track, yet when a "snake head" or broken rail had seduced them from their proper path it took whole panels of fence rails and any quantity of green saplings, enforced with strong remarks—in fact, denunciations on the contriver and contrivance—before they could be reinstated, and be induced to take to their narrow ways again. But it was want of capital, and lack of the knowledge that it is more difficult to farm a patent than to invent it, that prevented me from introducing it generally. But, however, it is not my object in writing to you to claim any particular credit in this matter, or to detract aught from that of my brother engineer, Mr. James Cleminson, in England, who has not only reinvented a valuable improvement, but has got it well introduced into use, and is in a fair way to bring it into general use. I wish him good speed and ample reward for his efforts in this line of railway improvement.

Yours very truly,

L. J. GERMAIN, formerly a C.E.

Cuyahoga Falls, Ohio, April 16, 1878.

* The patent referred to was for an improvement in railroad cars, by Lewis J. Germain, of Catskill, Greene County, New York State, issued May 7, 1839. The patentee represents in his patent a six wheeled car, having a separate frame for each pair of wheels; these frames operating upon each other, by means of a toothed segment and rack, or by means of jointed cross bars, on the middles of their sides of contact. The middle frame of the three which sustains the axles is so connected with the general car body frame above them as to allow a certain degree of vertical play to it, for the purpose of equalizing the bearing of the wheels on the rails; this is effected by means of what are called stands and slides. The wheels are thus to adapt themselves to the curvatures of the road and to its horizontal deviations. The claims are to the stands and slides in combination with the middle and top, or body frame, in the manner described, and to the manner of connecting the three axle frames together, by a single or double cross joint, or a rack and segment wheel.

Mechanical Oculists, and how they Treat Cinder in the Eye.

To the Editor of the Scientific American:

The best and most effectual treatment, and one which will give immediate relief from suffering caused by extraneous matter, loose in the eye, or attached to the eyeball or eyelid, is by extracting as quickly as possible said foreign substance. This is an operation frequently performed in our workshops, and very often in the machine and brass finishing departments, and always resulting in speedy and sure relief. To those who may not be as familiar with the operation as mechanics generally are, I will give a short description of the *modus operandi*. A keen, sharp, smooth edged penknife and a steady nerve are all that is required on the part of the operator, and for removing floating and loose substances the penknife will more readily attach itself to them if the point be magnetized by rubbing it on a common horseshoe magnet. Thus prepared, take the sufferer where you can have the benefit of a good light, and let him stand up and lean his head back against the wall, door jamb, or other suitable place; this is necessary that he might be able to hold his head steady. Then by standing square in front of him carefully examine the eyeball, and the corners of the eye, at the same time requiring the person to roll his eye to each side, and upwards and downwards, and by pulling down the lower eyelid explore the lower part of the eye and its cover, next catch the upper eyelashes between the thumb and forefinger and turn over the eyelid; this is usually done over the back of the penknife or a pencil; by this means the upper part of the eye and lid can be inspected. In the examination should the minutest speck be observed, examine it closely to determine whether it be a small blister, or pimple, or some foreign substance; if the former, let it alone severely, but if the latter remove it with the sharp point of the knife with a firm and steady hand. Some attempt this with a punching, spasmodic, nervous, picking motion; but to perform it skillfully it must be done with a confident, sure, cutting stroke, just as though it were to be sliced off, and, if possible, to cut the piece or strike it without touching the eye. The most difficult operation that we are called upon to perform is when a minute particle of iron or grindstone grit becomes firmly attached to the pupil of the eye. The eye becomes quickly inflamed from the irritation, also weak and watery, making it painful to open the eye, and if

the piece has cutting angles, a grain of emery for instance, the outer angles cut or scratch the eyelid, causing very severe pain; though it may be only as large as a pin's point, the sufferer feels it to be as large as a pea, and expresses considerable surprise at its minuteness upon examining it after its extraction, and wonders how so small an object could have given him so much pain and uneasiness. In extreme cases it becomes necessary to have a couple of assistants, one at each side, one to hold the head steady, the other to hold the eyelids open, so as to allow the operator a fair opportunity of making a sure stroke with the knife each and every time, for sometimes it will require many attempts to remove before it is effected, and in many cases the piece is broken off bit by bit until all is removed. One of the most eminent surgeons in this section, in passing one of our machine shops a short time ago, stopped and witnessed just such an operation as has been described, and was so much pleased with it that he remarked it was more skillfully and speedily performed than if he himself had done it, but he was not aware of the fact that the person doing it was an old hand at the business. In conclusion, I would recommend the immediate removal as indicated of any foreign substance in the eye, and if the eye becomes inflamed shield it from the light and apply cold water for a short time; nature will soon finish the rest. MECHANIC.

Pittsburg, Pa., April 12, 1878.

The Byrne Galvanic Battery.

To the Editor of the Scientific American:

In your issue of the 13th of April, I notice a description of a "Remarkable Galvanic Battery," as having been exhibited at a meeting of the Royal Society of Telegraphic Engineers, in London, and though the name of the inventor is not correctly given, there can be no doubt as to whose invention reference is made. This is an error of very trifling importance, however, and would hardly be deemed worthy of notice; but the description of the little apparatus referred to is faulty and imperfect in other respects, and likely to convey wrong impressions regarding its construction. I observe also that great diversity of opinion exists, and various theories have been advanced touching the causes of its extraordinary power. Under these circumstances, and as this voltaic novelty is now exciting considerable interest and no little philosophical speculation among British scientists, I feel called upon to furnish a more accurate description of its mechanism, and at the same time to submit what I deem the most reasonable interpretation of certain striking phenomena peculiar to its operation.

The accompanying woodcut will serve to give a correct notion of the general appearance of the battery.

A A, conducting cords; C, suspension rod and set screw combined, to connect between second and third cells in series; *a a*, poles of battery; *b b*, two set screws to couple for quantity; *d*, an extra binding post, not essential, but convenient when two cells only of the battery are required; *e e*, air tubes.

The composition of the fluid has been correctly stated, namely, one measure of commercial sulphuric acid to five of water, and to each pint of such dilution two ounces of bichromate of potash, though chromate of calcium, if substituted for the potash salt, will give a much higher electro-motive force, and, consequently, a much greater thermal power.

In order to guard against splashing, the quantity of fluid put into each cell should not exceed seven and a half fluid ounces, but, when the zincs become thin from use, eight ounces may be accommodated.

To connect the battery for intensity, turn down C firmly and raise *b b*; and for quantity, reverse the operation by turning down *b b* firmly and releasing C from its contact with the lower metallic connection.

In galvano-cautery, the main purpose for which this little battery was first devised, and is now being extensively used, and more particularly during certain difficult and complicated surgical operations, this simple means of changing the entire character of the current to meet emergencies is of the utmost importance.

For obvious reasons, the pneumatic agitator should be worked by quick and short impulses, and not by slow or prolonged compression of the bulb, and the battery should not be kept immersed except when in action.

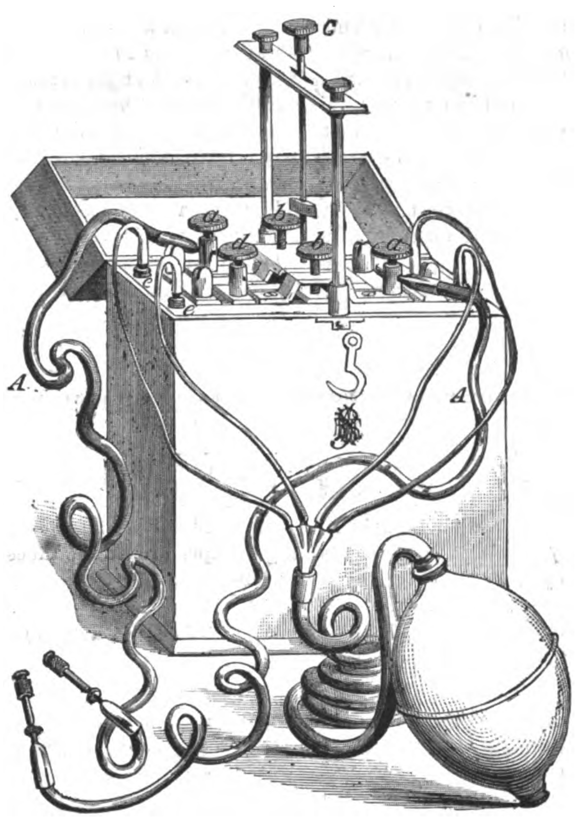
Finally, and in order that the aim contemplated in devising this voltaic organization, the lessening of internal resistance, may be correctly understood, I shall indicate, in a few words, the manner of preparing my patent negative plates, the distinctive feature of the battery, and the main source of its great power.

Each negative element consists of a plate of copper, to one surface of which, as well as to its edges, a sheet of platinum foil, compact, and free from pin holes, is soldered, and to the opposite surface or back a sheet of lead, the three metals being so united that the copper shall be effectually protected from the action of acids. The lead back and edges are then coated with asphaltum varnish, acid-proof cement, or any other like substance; and, lastly, the platinum face, being first rubbed over gently with emery paper, is to be thoroughly platinized in the usual manner.

Each cell of the battery above described contains two such plates, between which a single zinc is suspended, and when the elements are immersed so that the exciting fluid reaches within an inch of the top, a negative surface of 20 square inches is brought into action. It will thus be seen that the platinum alone is the negative metal, and the copper core a conducting body merely, while the lead, being almost passive, serves no other purpose than to protect the copper, so that any other, and, best of all, a non-metallic, substance capable of resisting the action of bichromate solutions, might, with advantage, be substituted for the lead.

By this device the fixed and well known electro-motive energy of a platinum-zinc pair, which, I need hardly say, is much higher than that of platinized silver, and, combined therewith, the conductivity of copper, are insured in one and the same compound element. As might be supposed, therefore, the practical result is that the only internal resistance to be encountered is that of the fluid, which, in the apparatus under consideration, must necessarily be quite small, since the zinc and platinum surfaces are no more than three sixteenths of an inch apart. As to the electro-motive force in bichromate fluid, repeated and carefully conducted tests, by General H. L. Abbot, U.S.A., and others, prove this to be from 1·95 to 1·99 volts. Now, as this battery will show, during agitation, on a tangent galvanometer, with no external resistance, a deflection of 82°, or nearly 50 webers, it follows that the internal resistance cannot be much over 0·04 of an ohm.

This, then, is the basis of what has been justly claimed for and accorded my battery, namely, "a remarkably high electro-motive force, with an almost immeasurably small internal resistance." Nor is this most desirable condition limited to the particular form of battery herein described, for these conducting negative plates have proved to be infinitely superior to carbon in a porous cup with concentrated



THE BYRNE GALVANIC BATTERY.

bichromate of potash and sulphuric acid. As compared with platinized silver, also, with sulphuric acid and water, say one to ten or eleven, as an exciting liquid, not only will the electro-motive force be found to be twenty-five per cent or more higher and the resistance less, but, there being no internal currents due to a platinum-silver pair, and comparatively little tendency to polarization, the action will be steadier than that of the most perfect Smee battery. Hence these plates are admirably adapted, and have been successfully tried, for operating electro-motors, for electro-plating and other purposes.

With regard to the heating capacity of my battery, and the *modus operandi* by which pneumatic agitation increases its power, I have but a few words to add, suggested by reading the report of what took place at its exhibition in London.

It has been stated that "ten of my cells heated a stout platinum wire, thirty inches long and No. 14 B. W. G., to a glowing heat on pumping," and as evidence of the surprise created by this demonstration, the report goes on to say that "some idea will be formed of the great heating power here displayed, when it is remembered that it takes seventy or eighty Grove's elements to heat a similar length of No. 18 or 24 B. W. G. platinum wire." Now, inasmuch as I have often shown that four of these cells will heat to an equal degree from fifteen to eighteen inches of such wire, ten cells ought to, and would, I know, bring to a like condition considerably more than thirty inches. I am disposed, therefore, to surmise that the amount of this thick wire within reach at the time may probably have been limited to thirty inches, or there must have been some imperfection in the plates or cells used. At all events, the little battery of four cells will heat to a bright cherry-red twenty inches of No. 16 platinum wire.

As to the "development of heat within the cells," and "why the pumping of air into the cells should increase its current strength so much," it seems to me the distinguished electricians who are reported to have been present at this exhibition will, after a little reflection, find no difficulty in settling both questions to their entire satisfaction. I may state, however, that if a plate of amalgamated zinc, say $2\frac{1}{4} \times 5$ inches, and $\frac{3}{16}$ thick, be immersed, *alone*, in 8 fluid ounces of strong bichromate fluid, the temperature of said fluid will rise to nearly 140° F. in about half an hour, or within a few degrees of the highest point reached during prolonged electro-chemical action and agitation. Whether the slight retardation of the current by the fluid may add a fraction to the heat produced by chemical decomposition, I am not prepared to say; but it is quite certain that the development of heat within the cell is due in a great measure, if not entirely, to chemical action of the fluid on the zinc, and this is one among other reasons why the plan of suspending one zinc between two negative surfaces has been adopted.

Where cells have been employed to operate electro-magnetic motors, however, and the exciting fluid has been sulphuric acid and water merely, I prefer to use a single negative surface and one zinc. In this case there is little or no chemical action on the zinc, beyond what is represented in current, and the energetic disengagement of hydrogen insures a free circulation in the liquid.

With regard to the method adopted for agitating the fluid, I have only to say that, after many experiments and trials with various other contrivances, this has been found the most simple and convenient. That agitation has no influence whatever on the electro-motive force of the battery is unquestionably true, as Mr. Preece has demonstrated, nor has it much, if anything, to do in the production of heat within the cells. In fact, its action is purely mechanical, and agitation by any other device, if equally practicable, would accomplish the same result.

The suggestion of Professor Adams, as to its effecting a free circulation in the fluid, by which the metallic surfaces are kept constantly clear or, to use a meaningless term, *depolarized*, is, undoubtedly, a hint in the right direction, and in entire conformity with my own views.

JOHN BYRNE, M. D.

314 Clinton St., Brooklyn, April 15th, 1878.

American and English Weather Warnings.

To the Editor of the Scientific American:

I was much interested in the *résumé*, given in your issue for March 23, of Mr. Bennett's report of his storm warnings, which have created so much interest on this side, especially as I had just received from Mr. Scott, Secretary of the London Weather Office, the reprint of his paper upon the same subject, read before the Nautical Society. The comparison given below shows that there is considerable variance between the two reports. Though, as Mr. Scott says, "meteorologists are most deeply indebted to the generous public spirit of the proprietors of the New York *Herald* for their great liberality in transmitting these warnings gratuitously," it has been found impossible to make much or any practical use of them on our own coasts. The newspapers have naturally noticed them, since even one correct warning, even if a dozen proved incorrect, is seized on and wondered at by the public mind.

The following table refers to the same period (February 15 to December 31). Mr. Scott gives, in a full table, the date and wording of each warning; the actual meteorological conditions at the date indicated, from the returns for Western Europe; the measure of success, shown by the comparison; and a column for comments. Mr. Bennett's results are taken from your columns.

Description.	Bennett.	Scott.		Description.
Entirely correct	31	7 or	17·5 per cent.	Absolute success.
Correct in general	8	10 or	25 per cent.	Partial success.
Correct in particular parts	5	6 or	15 per cent.	Very slight success.
Failed	2	17 or	42.5 per cent.	Absolute failure.
	46	40	100	

The totals represent the supposed distinct storms predicted in 36 telegrams. After his table, Mr. Scott adds: "These figures, therefore, show that not 45 per cent of the warnings can be considered really successful. What is meant by 'really successful' is that the information conveyed by them was of real value to seamen in British ports."

Their chief value, he considers, is for ships crossing the Atlantic, since "storms in winter, like misfortunes, never come single," and they may expect bad weather as they approach the American coasts.

York, England. J. EDMUND CLARK.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, May 11, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	4 36 mo.	Saturn rises	2 38 mo.
Venus rises	3 01 mo.	Uranus in meridian	6 33 eve.
Mars sets	10 31 eve.	Uranus sets	1 25 mo.
Jupiter rises	0 30 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	0 56 mo.	Regulus in meridian	6 43 eve.
Algol (2d-4th mag. var.) sets	8 50 eve.	Spica in meridian	10 00 eve.
7 stars (cluster) sets	7 51 eve.	Arcturus in meridian	10 51 eve.
Aldebaran sets	8 08 eve.	Antares rises	8 43 eve.
Capella sets	11 57 eve.	Vega in meridian	3 17 mo.
Rigel sets	7 21 eve.	Altair rises	9 56 eve.
Betelgeuse sets	8 55 eve.	Deneb rises	7 23 eve.
Sirius sets	8 22 eve.	Fomalhaut rises	3 36 mo.
Procyon sets	10 33 eve.		

REMARKS.

Mercury is now invisible. All the planets, except Jupiter, now have northern declinations. We mention the stars in the order of their right ascensions, this week, for the first, and will do so hereafter. We do not give the ephemerides of Algol, as it sets so early in the evening as to render observation impracticable.

OSTRICH FARMING IN SOUTH AFRICA.

We present a series of illustrations, taken from the *Illustrated London News*, of this new and profitable industry in South Africa. They are from photographs taken on the estate of Mr. A. Douglass, near Grahamstown, who was the originator of ostrich farming, and is the largest ostrich proprietor. Ten years ago Mr. Douglass obtained three wild birds, and afterwards eight more. As soon as he found they would lay in confinement, he began his experiments in artificial hatching. This attempt met with but little success for three years, till he invented the patent incubator, the success of which has become renowned. By its means he has increased the eleven birds to 900, and these and others, becoming dispersed throughout the colony, have made ostrich farming, next to wool and diamonds, the most important industry of South Africa.

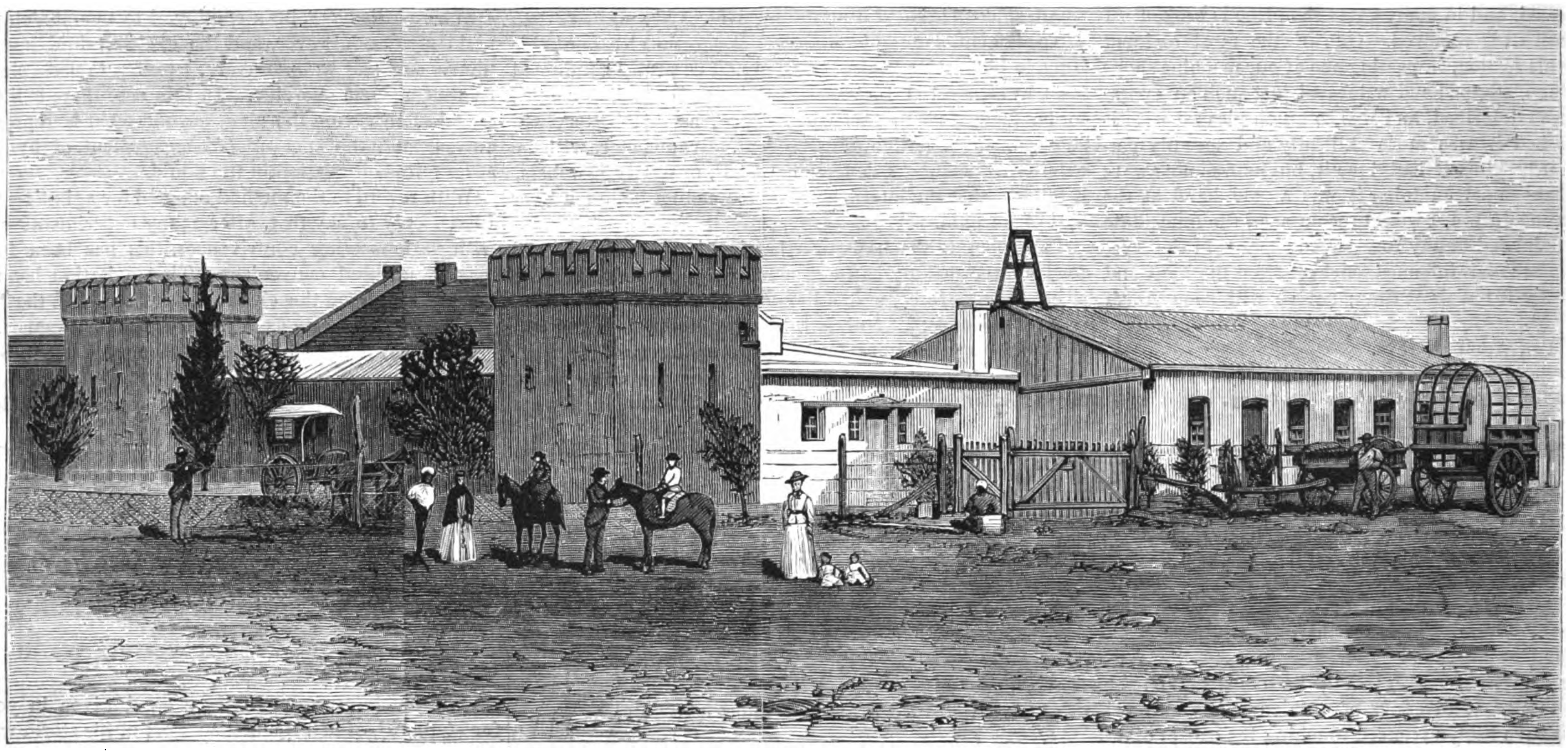


Fig. 1.—HEATHERTON TOWERS, NEAR GRAHAMSTOWN.

Mr. Anthony Trollope's recently published book on "South Africa" contains the following description: "Mr. Douglass is, among the ostrich farmers of the colony, about the most successful, and the first who did the work on a large scale. He is the patentee for an egg-hatching machine or incubator, which is now in use among many of the feather growers of the district. Mr. Douglass occupies about 1,200 acres of rough ground, formerly devoted to sheep farming. The country around was all used not long since as sheep walks, but seems to have so much deteriorated by changes in the grasses as to be no longer profitable for that purpose. But it will feed ostriches.

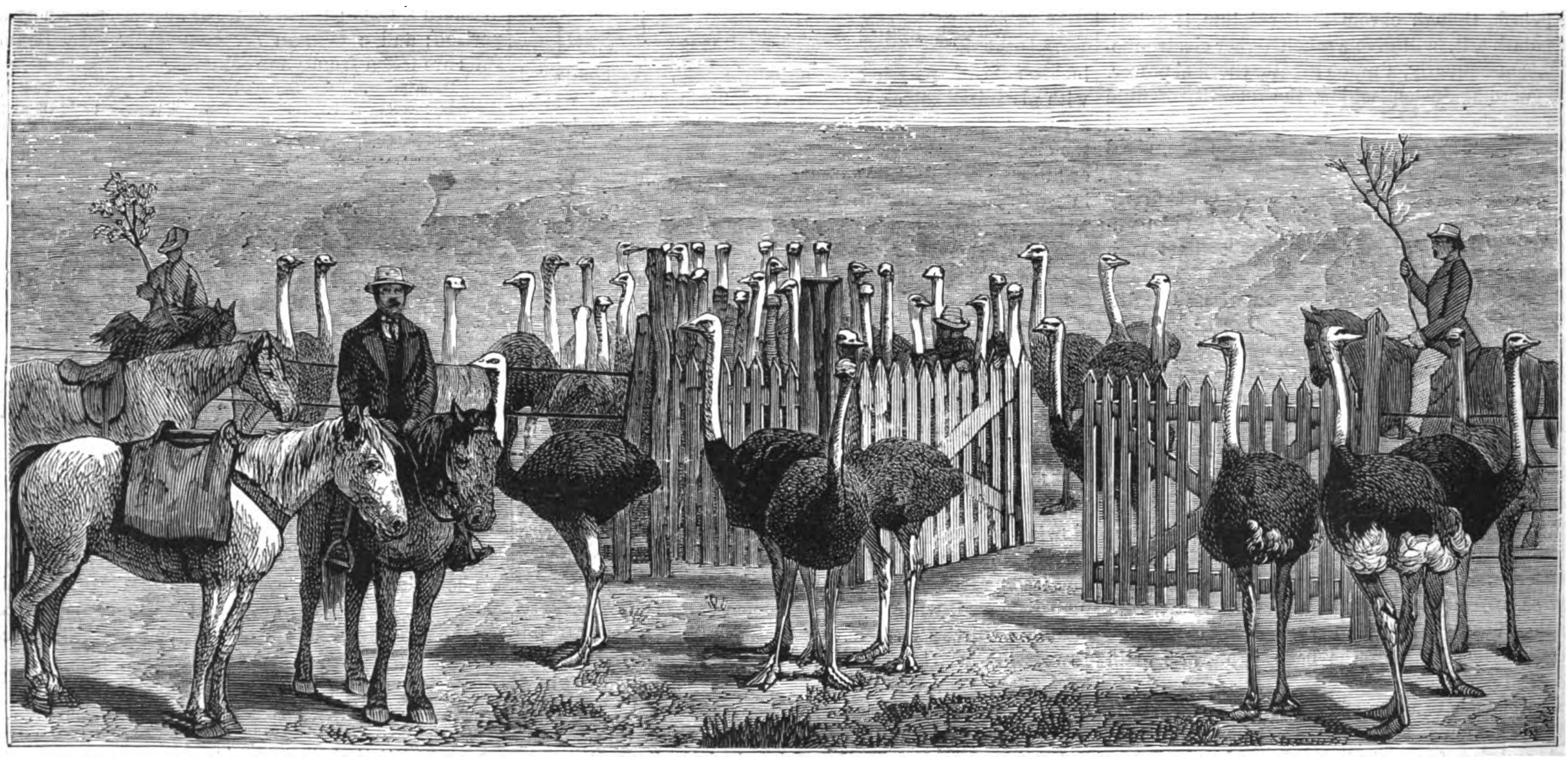


Fig. 2.—BIRDS MUSTERING.

"At this establishment I found about 300 of those birds, which, taking them all round, young and old, were worth about £30 apiece. Each bird fit for plucking gives two crops of feathers a year, and produces on the average feathers to the value of £15 per annum. The creatures feed themselves, unless when sick or young, and live upon the various bushes and grasses of the land. The farm is divided out into paddocks, and, with those which are breeding, one cock with two hens occupies each paddock. The young birds—for they do not breed till they are three years old—or those which are not paired, run in flocks of thirty or forty each.

"Ostrich farming without the use of an incubator can never produce great results. The birds injure their feathers by sitting, and at every hatching lose two months. There is, too, great uncertainty as to the number of young birds which will be produced, and much danger as to the fate of the young bird when hatched.

"The incubator is a low, ugly piece of deal furniture, standing on four legs, perhaps eight or nine feet long. At each end there are two drawers, in which the eggs are laid with a certain apparatus of flannel; and these drawers, by means of screws beneath them, are raised and lowered to the extent of two or three inches. The drawer is lowered when it is pulled out, and is capable of receiving a certain number of eggs; I saw, I think, fifteen in one. Over the drawers and along the top of the whole machine there is a tank filled with hot water, and the drawer, when closed, is screwed up so as to bring the side of the egg in contact with the bottom of the tank. Hence comes the necessary warmth. Below the machine and in the center of it a lamp or lamps are placed, which maintain the heat that is required. The eggs lie in the drawer for six weeks, and then the bird is brought out.

"All this is simple enough, and yet the work of hatching is most complicated, and requires not only care, but a capacity of tracing results which is not given to all men. The ostrich turns her egg frequently, so that each side of it may receive due attention. The ostrich farmer must therefore turn his eggs. This he does about three times a day. A certain amount of moisture is required, as in nature moisture exudes from the sitting bird. The heat must be moderated according to circumstances, or the yolk becomes glue and the young bird is choked. Nature has to be followed most minutely, and must be observed and understood before it can be followed. And when the time for birth comes on, the ostrich farmer must turn midwife and delicately assist the young one to open its shell, having certain instruments for the purpose. And when he has performed his obstetrical operations he must become a nursing mother to the young progeny, who can by no means walk about and get his living in his earliest days. The little chickens in our farmyards seem to take the world very easily; but they have their mother's wings, and we as yet hardly know all the assistance which is thus given to them. But the ostrich farmer must know enough to keep his young ones alive, or he will soon be ruined; for each bird when hatched is supposed to be worth £10. The ostrich farmer must take upon himself all the functions of the ostrich mother, and must know all that instinct has taught her, or he will hardly be successful.

"The birds are plucked before they are a year old, and I think that no one as yet knows the limit of age to which they will live and be plucked. I saw birds which had been plucked for sixteen years, and were still in high feather. When the plucking time has come, the necessary number of birds are enticed by a liberal display of mealies—as maize or Indian corn is called in South Africa—into a pen, one side of which is movable. The birds will go willingly after mealies, and will run about their paddocks after any one they see, in the expectation of these delicacies. When the pen is full, the movable side is run in, so that the birds are compressed together beyond the power of violent struggling. They cannot spread their wings, or make the dart forward which is customary to them when about to kick. Then men go in among them, and, taking up their wings, pluck or cut their feathers. Both processes are common, but the former, I

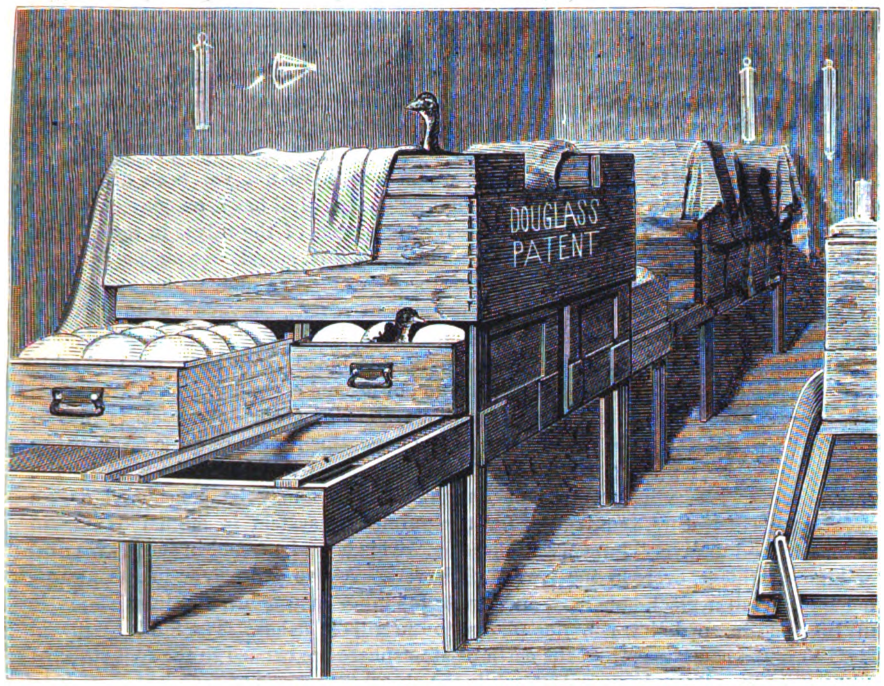


Fig. 3.—THE INCUBATING ROOM.

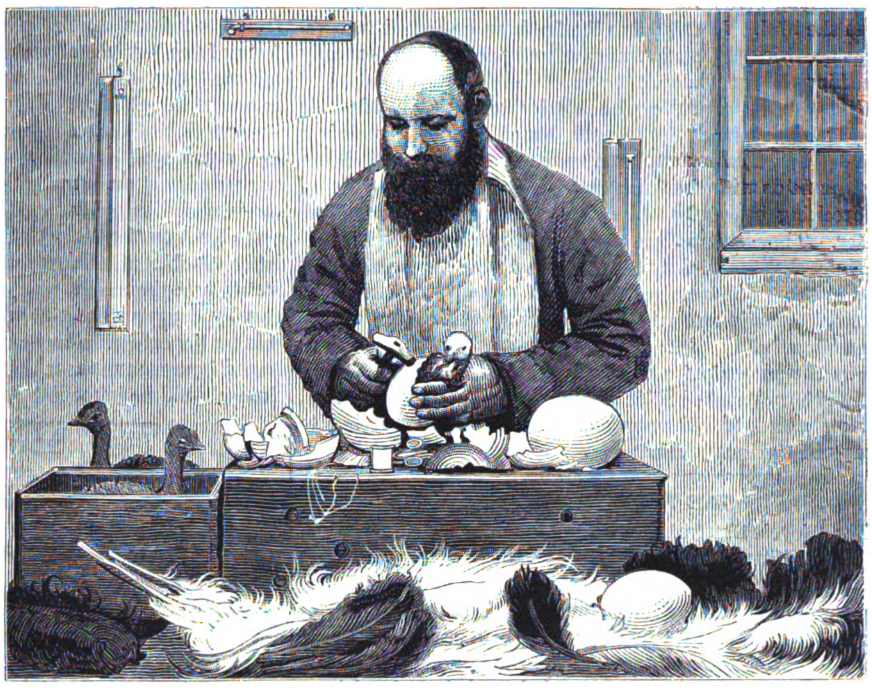


Fig. 4.—HELPING OUT A WEAK ONE.

think, is most so, as being the more profitable. There is a heavier weight to sell when the feather is plucked; and the quill begins to grow again at once, whereas the process is delayed when nature is called upon to eject the stump. I did not see the thing done, but I was assured that the little notice taken by the animal of the operation may be accepted as proof that the pain, if any, is slight.

"The feathers are then sorted into various lots; the white primary outside rim from under the bird's wing being by far the most valuable--being sold at a price as high as £25 a pound. The sorting does not seem to be a difficult operation, and is done by colored men. The produce is then packed in boxes, and sent down to be sold at Port Elizabeth by auction."

Fig. 1 is a view of Heatherton Towers, the residence of Mr. A. Douglass, in the Fish River Valley, eighteen miles from Grahamstown.

Fig. 2 is the scene of mustering the birds, which run in flocks in large inclosures. The one where our view is taken is 3,000 acres, with a troop of 240 birds in it. Here, once a week, they are all hunted up by men on horseback, armed with large boughs of thorn, to keep the birds off, as many are very savage, and their kick is dangerous. One man will be observed in front, with a pack horse, loaded with Indian corn, to lead them.

The incubating room is shown in Fig. 3. It is a large building so constructed as not to be affected by change of weather. Here several incubators are at work; in one an egg can be seen just broken through. On the top of the machines are the birds' sleeping places, all heated. The drawers are represented as when lowered and drawn out, to show them; when again pushed in, they are lifted and fastened by large screws beneath them.

In Fig. 4, Mr. Douglass is represented in the act of helping a weakly bird out of its shell. By certain signs discovered by himself it can be told to an hour when the bird is ready; but it often happens that the bird cannot pierce the shell, and unless helped would die.

Fig. 5 is the interior of the feather room. We are informed that the birds are plucked twice a year; that is, the tail and the primary wing feathers, which are the only white feathers, are plucked, and the secondary wing feathers, which

Fig. 5.—THE FEATHER ROOM.

Fig. 6.—COOLY WITH YOUNG BIRDS.

Fig. 7.—A BIRD SITTING.

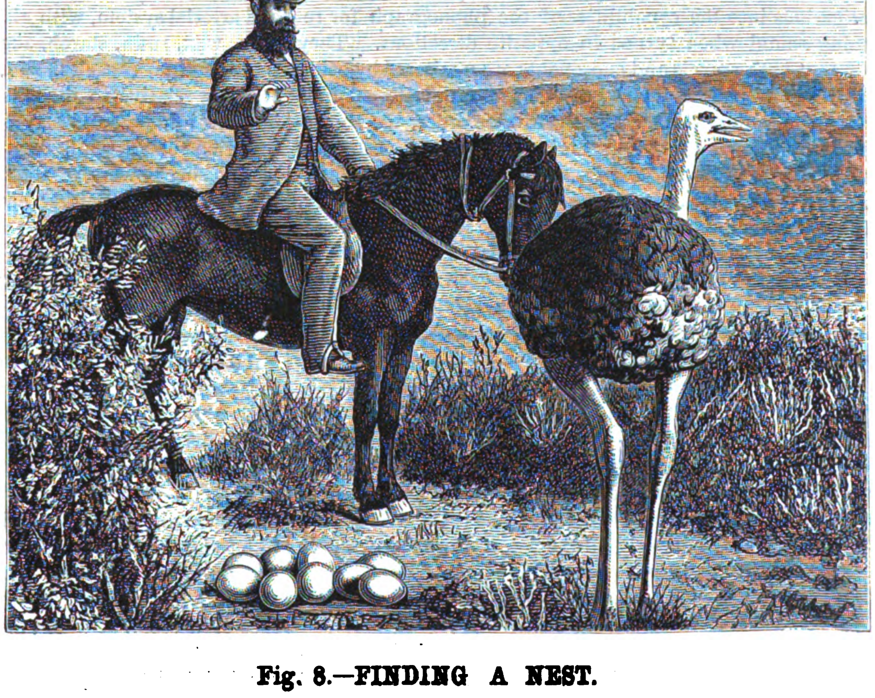


Fig. 8.—FINDING A NEST.

are the long black feathers. These are all that are taken from the bird. In this room the feathers are sorted into various qualities, tied up in bunches, and packed in cases ready for shipment to London.

Fig. 6 shows a coolie with his lot of young birds. It should be explained that to each lot of about thirty birds a man is told off, who from sunrise to sunset goes about in the lucerne fields with them, cutting up the lucerne for them, or breaking bones for them, and finding them gravel and water. They become immensely attached to their nurse.

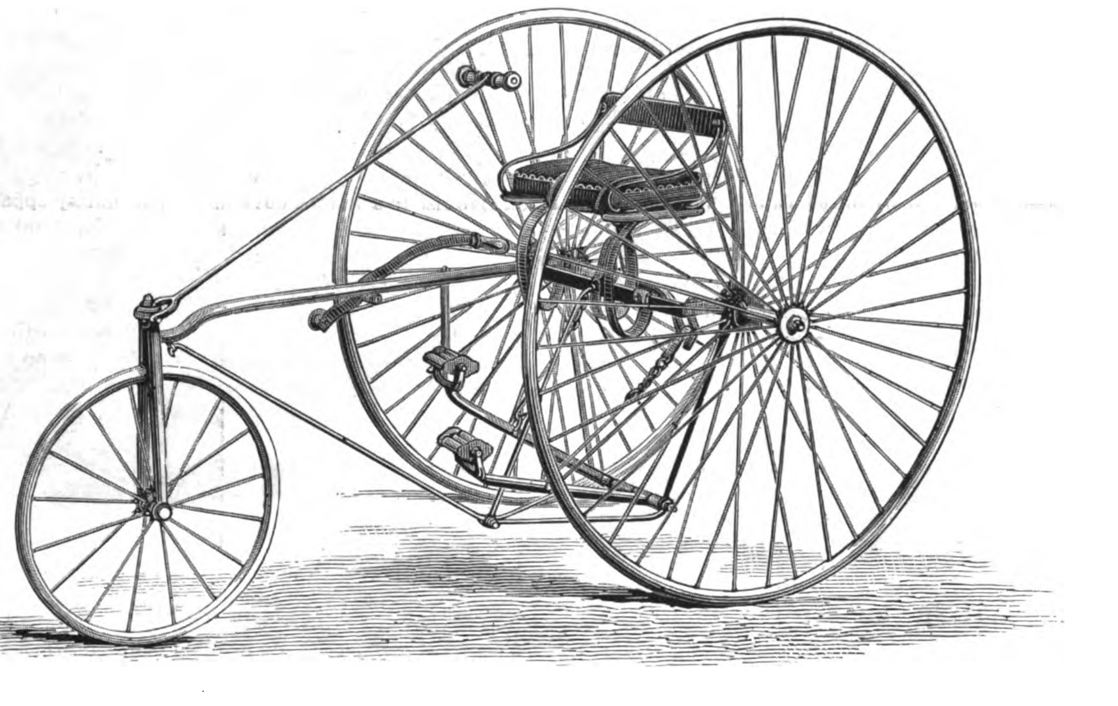
Fig. 7 shows a bird sitting on her nest. The hen sits by day and the cock by night, except in wet weather, when the cock will remain on day and night, being evidently afraid to trust his wife.

Fig. 8 represents "a find." It is often a serious matter to find the nests; the bird is in anger at being disturbed, and, if a male bird, would soon send horse and rider flying to escape his furious kicks.

THE PREMIER TRICYCLE.

The tricycle illustrated on this page is an English machine, made by Hillman & Herbert, of Coventry. The engraving we copy from *Iron*. The framework is a horizontal bar, bent into a rectangle, with a double-throw crank axle running in anti-friction roller bearings, which are bolted to the frame. Two large wheels, from 46 to 50 inches in diameter, are mounted upon this axle, one of them being the driver. Three C-springs are also bolted to the frames, to support the seat, and two rods, extending downward, carry a steel bar, whereon the pedal levers are pivoted. A stout tube connection for the guiding wheel is also bolted to the framework, and is curved so as to be out of the way of the feet and legs, and render the machine suitable for ladies as well as gentlemen. The guiding wheel is 22 inches in diameter, and runs upon an adjustable double-coned pin in an upright fork, about 4 feet in advance of the crank axle, and exactly midway between the large wheels. Its handle is very conveniently pivoted, so that it may be turned over or reversed, and used to draw the machine when necessary, as in the case of steep hills. The wheels are all tired with Para rubber, and their fellies are of U-shaped steel, while a powerful roller brake is attached to the driving wheel, the lever being at the right hand of the rider.

The steel bar carrying the propelling levers is placed as near the ground as safety permits. It is strengthened by a couple of steel rods projecting under the pedal levers in such wise that the double purpose is served of imparting perfect rigidity to the bar, and supplying a guard or stop in case of the pedal levers and crank becoming broken or unhinged. Without such a guard, serious accidents might occur, in spite of the best workmanship and materials, by the pedal dropping and catching the ground while the machine is in progress. The pedals are rubber-cushioned, and the connections are adjustable to suit length of leg. A step is fixed on the right side for mounting and dismounting, while the back of the seat is arranged to carry any amount of luggage.



THE PREMIER TRICYCLE.

Reversed Speech.

Messrs. Jenkins and Ewing have recently made some investigations into the capabilities of the phonograph for reversing sound when turned in opposite directions. They state that both vowels and consonants are unaltered by being spoken backwards; and that, whether the pulsations of air be made in a given order or in the reverse order, the ear accepts the sound as indicating the same letter. Consonants between single pairs of syllables, as *ada*, *aba*, etc., are identifiable quite as well backwards as forwards. *Ab*, however, said backwards becomes *ba*, and thus the investigators suggest we have here a standard of what does really constitute a single letter or element of articulate speech: it is any one reversible part. The word *noshaecsossa* pronounced in the phonograph is reproduced very clearly as *association*.

A New Grain Elevator in New York.

The New York Central and Hudson River Railroad Company are about to construct another grain elevator in close proximity to that at 60th street and North river in this city, illustrations of which we published about a year ago. The new building will have a capacity of about 800,000 bushels of grain, and is to embody all the latest improvements in elevator construction.

Contagion by Mail.

The London *Telegraph* has recently published a correspondent's letter setting forth a remarkable instance of scarlet fever being communicated by a letter. A lady wrote to a friend to inform her that she was nursing her daughter, suffering from scarlatina. The friend, after reading and burning the letter, gave the envelope in which it was contained to one of her children to play with. Shortly after, the child became sick of the same disease, which the physician traced to his own satisfaction to the infected letter. It might be suggested that an examination into the prevalence of contagious maladies among post office employés would throw some light on the danger of a possibly infected mail. One letter capable of communicating scarlet fever or small pox would probably render every other missive in the same pouch equally dangerous as a disseminator of disease. At any rate it is on the safe side to send no communications from infected houses save those that are absolutely necessary, and these should be immediately burned.

PLANT MIND.

V.

VEGETABLE ANATOMY.

Exquisite sensibility to all the powerful agents of Nature, heat, light, cold, moisture, drought, favorable and unfavorable surroundings, and even kind or unkind treatment, ever responsive to loving care, and drooping under chill neglect, are undeniable characteristics of plant life; and in so delicate an organization need we be surprised to find a complete analogue to the anatomical structure of animal and animated beings?

Among the ancients we find a continual recognition of the male and female, or principle of distinctive sexes, in vegetable creations; and Pliny taught that "in all trees and plants, nay, rather, in all things that proceed out of the earth, even in the very herbs, there are both sexes;" while the catalogues of the sixteenth century invariably recognize this distinction. In the "Philosophia Botanica," the parts of a flower are described by Linnæus in strictly anatomical terms, while the botanical text-books of the present day admit the fact as no longer to be questioned.

Has there been convincing proof of the existence of a correspondent collection of parts, which constitute not resemblances alone, but parity of functions? Replies are made in the affirmative by those who are familiar with the revelations of the modern microscope. There are a complete system of absorbent vessels, lacteals, and lymphatics; a pulmonary and arterial system, with glands for the separation of honey, gum, wax, resin, starch, sugar, essential oil, etc.; organs of reproduction, muscles, and, we think, *nerves*, although researches relative to the existence of nerves in plants are yet in their infancy, and may be guessed at rather as exhibited in action than actually seen in their minute reality. As the magnifying powers of the microscope have not yet reached their ultimatum, neither have explorations yielded all their secrets.

There are three systems of absorbent vessels in plants, namely, lymphatics, lacteals, and placental vessels for the nourishment of the embryo. The vessels which in plants correspond to the lacteals in animal beings are those which imbibe nutriment from the earth in the form of moisture; these are abundant in the roots, they flourish when supplied with water, and die when it is wanting.

The openings of the lymphatic vessels are to be found on the external surfaces of the bark and leaves, on the internal surfaces of all the cells, and between the bark and alburnum or sap wood. By Grew and Malpighi, these were supposed to be air vessels, but later observers have decided that conclusion to be erroneous. The absorbent vessels on the under side of a leaf prevent speedy death when laid upon the surface of a vessel of water, while a leaf placed with its upper side next the water will speedily decay or dry away. Moisture imbibed through these vessels will keep alive for some time the bark of a separated branch, and the alburnum or sap wood may be kept in the same manner.

By careful observation and experiment, an arterial system may also be detected. These experiments are usually made with the aid of colored decoctions upon plants which have a white blood or circulating medium. Their structure is in the form of a spiral line, but not interrupted by valves; at least the valves, we believe, have not yet been discerned. The vermicular motion of the spiral has been conjectured to be the equivalent for the action of the valves in the arterial system of animal beings, as each spiral ring pushes forward its contents by means of contraction, and, with a retrograde movement of the absorbent vessels, conveys moisture downwards as well as upwards. The sap is very generally admitted to be true vegetable blood, or to be to the vegetable just what blood is to our animal economy.

In addition to this system of absorbent vessels is also to be found a systematic apparatus for the purpose of exposing to the action of the atmosphere the fluids absorbed by the lacteals and lymphatics. This may be considered as an equivalent for the pulmonary system in animal life or in human organization. This is to be found in the leaves and in the petals of flowers. Above ground, or in the atmosphere, it answers to the lungs in animals, and in sub-aquatic or marine plants, to the gills in fishes. The fluids absorbed from the earth or atmosphere are carried to the foot stalk of every leaf, while the absorbent vessels of each leaf unite into branches and form pulmonary arteries, which are dispersed to the extremities of each leaf. In the leaf we behold the pleasing object of a complete circulation, with a pulmonary vein receiving the blood from each artery on the upper side of the leaf; while again, uniting in the foot stalk of the leaf, these veins form aortas, dispersing new blood over the new bark, elongating its vessels, or producing new secretions. The vessels in the intertexture of the bark are so minute that the venous system cannot be fully investigated without the aid of more powerful microscopes than we now have; but reason is always in advance of experiment, and we do not attempt to invent; we only try to discover facts.

As the corols or petals act as lungs to the flower or fruit, as it is called in botanical language, much of the process may be seen by the naked eye, for in these organs the vegetable blood is brought into contact with air and light. These vessels are all extremely sensitive to the stimulus of fluids received, and propel them upwards with great force. This susceptibility to irritation from juices absorbed, with their increased activity in the warmth of spring, proves the immediate presence of a vital force, and resembles in the minutest particular the action of similar vessels in animals.

In the "Veget. Stat." of Dr. Hales, the above statements are verified by experiments, which may be easily repeated.

Indeed, the analogy between the breathing apparatus of animals and the leaves of plants is so complete that it may be accepted as an undisputed fact in regard to the organic life of plants. A thin pellicle or membrane protects while exposing the vegetable blood to the action of the atmosphere, upon the upper surfaces of leaves, or organs of respiration. (*Vide* Bonnet, "Usage des Feuilles.") Leaves continue green many days when placed with the *under* surface in contact with water; but, if with the *upper* side next the water, they soon die. In aquatic plants it is the *under* side which lies upon the water, but the *upper* which is exposed to the action of the air and light. That leaves act the part of lungs, or giving out a phlogistic material to the atmosphere and inhaling oxygen or vital air, is no longer a subject of dispute among the learned.

Aquatic plants afford very marked illustrations of the above assertions. The lower leaves of the *Trapa* being beneath the water are divided into minute capillary ramifications, either getting from or giving to the water the indispensable oxygen, thus answering in their office to the gills in fish. The upper leaves of the *Trapa* are broad and round, with air bladders in their foot stalks, by which they are supported above the surface of the water. These upper leaves are undivided, while they are found below the water cut into fine divisions. These minute subdivisions of sub-aquatic plants may also facilitate the separation of the air by their points or edges. The contained air finds at the point of each fiber a place where the resistance to its expansion is less, and it there expands and becomes a bubble of air.

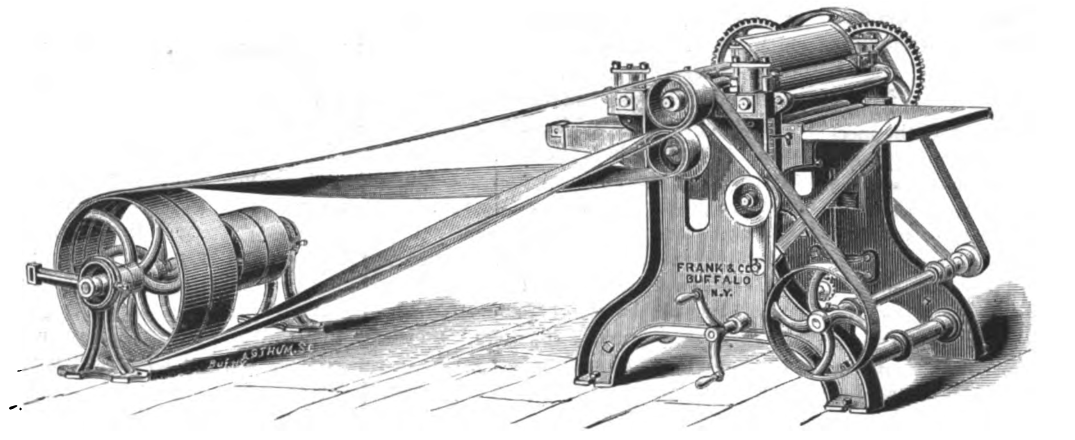
On very high mountains, where the atmosphere is of great rarity or thinness, the reverse arrangement has been noted, the upper in place of the lower leaves being finely divided, and thus affording a larger surface of contact necessary for the welfare of the plant individual.

R. C. K.

IMPROVED WOOD PLANER.

This machine is well adapted for planing lumber for all kinds of boxes, sashes, doors, window and door casings, etc. In planing door panels it does its work sufficiently smooth so as not to require any hand planing, and it is substantially built of the very best material. The bearings in which the cutterhead journals run are cast solid to the frame and are self-oiling. The lower cylinder is placed so near under the upper one that the bed or plate over it passes as far under the upper cylinder as it can and escapes the cutters. It is claimed that this, when once properly adjusted, does not require to be readjusted when the machine is changed to plane different thicknesses of lumber, as is necessary with other double-surfacing planers. This planer has a feed roll outside of the under cutter head to carry the lumber clear from the machine after the lower cylinder has done its work, which is a feature not often found in the large double surfacers in use. The countershaft furnished with this planer has C. Purdy's patent self-oiling device for the loose or idle pulley. Three sizes are constructed to plane 16, 20, and 24 inches wide, and from ⅛ to 8 inches thick.

Further information may be had on application to Frank & Co., 176 Terrace street, Buffalo, N. Y.



DOUBLE SURFACING PONY PLANER.

Jute Culture and Manufacture in the South.

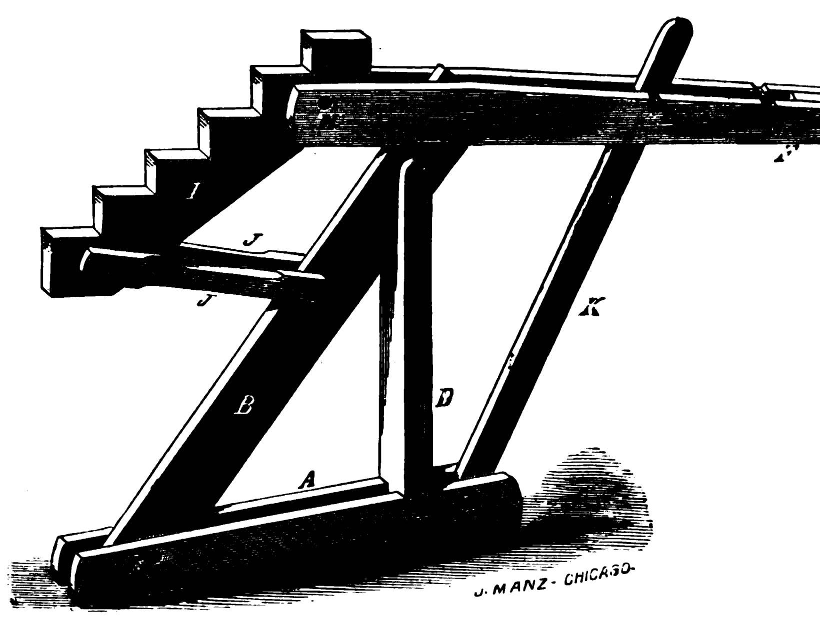
There is now in progress of organization in Charleston, S. C., a factory for the manufacture of cotton bagging from jute, which, it is said, will be in operation in less than two months. Jute seed has been distributed by the Agricultural Society of that State to about sixty planters along the coast, so that it is believed that within a very short time the South will raise, spin, and weave jute, not only for its own use, but for other districts. The culture and manufacturing of jute have become very extensive, as a million acres of land in India are devoted to its cultivation, and one factory near Calcutta employs 4,000 workmen, while at Dundee, in Scotland, there are said to be about a hundred jute mills, employing some 20,000 operatives.

It is believed that the South can grow jute as successfully as India can, and manufacture it as profitably as it can be done in Dundee, and that it will be done if the import duty on jute be allowed to stand until the Southern plantations and factories are allowed to have a fair start. To some extent the cultivation and manufacture of jute are an experiment, and unless there be a prospect of handsome returns, neither planters nor manufacturers will want to have anything to do with it. Notwithstanding this, it is proposed, just as the plantations and factories are about to make a beginning, to reduce the duty on jute, and expose such enterprises to a competition that did not exist and was not expected when they were projected. This is neither politic nor just, for, so long as the protective system exists, its beneficent effects should be felt by all young industries, whether in the North or South.

IMPROVED LIFTING JACK.

We illustrate herewith a new and simple lifting jack, applicable to all kinds of vehicles. The base, A, supports an inclined bar, B, and standard, D. The lever, F, has its fulcrum at G, in bar, B, and extending forward is pivoted to the notched bar, I, which is connected by the bar, B, by the short bars, J. It will be evident that when the lever, F, is operated the notched bar will be raised or lowered. The axle of the vehicle rests upon one of these notches according to the height of the axle. K is a bar which is pivoted to the base, and which extends upward above the lever, F. It carries a pin, L, which, when the jack is loaded, falls into one or the other of the recesses, M, in the top side of the lever, and thereby holds the load. When the load is to be lowered the rear end of the lever, F, is depressed to release the pin, when the bar, K, is thrown forward with the foot. The lever is then allowed to rise and release the jack. The device is strongly and inexpensively constructed.

Patented through the Scientific American Patent Agency, February 15, 1876. For further information relative to sale of territory, except Ohio and Illinois, address the inventor, Mr. James S. Rowland, Senecaville, Guernsey county, Ohio.



ROWLAND'S IMPROVED LIFTING JACK.

MR. JOHN L. STROUB, the inventor of the convenient apparatus for baking clams, illustrated on page 279 of the last issue of the SCIENTIFIC AMERICAN, may be addressed at 93 Canal street, New York city.

AMERICAN ACADEMY OF SCIENCES.

The annual meeting of the above named association convened at Washington, D. C., on April 15, under the Presidency of Professor Joseph Henry. The following are brief abstracts of the papers read.

ALACRANE REEF.

Professor Alexander Agassiz described the formation and structure of Alacrane Reef, in the Yucatan Bank, which at first sight appears to present features incompatible with the general theory of the coral reefs of this region, as set forth by Mr. Darwin, but on a more careful examination it confirms that theory. It is believed that the whole region of the Florida reefs and neighborhood is one of elevation. Cuba is the axis of elevation, and eventually this formation will fill the whole space of those waters. The elevation is comparatively recent. Alacrane Reef will serve as an epitome of the whole. Similar observations had been made on the neighboring coast of South America, and Professor Agassiz believes there is evidence to show that before this elevation, and late in the Tertiary period, the place now occupied by the Isthmus of Panama was the seat of a great equatorial current, which has produced a marked effect upon the fauna of adjoining oceans.

WATERSPOUTS.

Professor Ferrel spoke on the mathematical theory of waterspouts, and stated that a waterspout is simply the cloud by means of the centrifugal force of the gyrations diminishing the tension. It is not the fall of a body of water carried up as water. The conditions which give rise to a waterspout continue to supply it with material to support it. With a high temperature and an unusually low dew point, differing 16° from the temperature of the air, waterspouts a mile high have been produced.

MARS' MOONS.

Professor Asaph Hall read an essay on the orbits of the satellites of Mars. The eccentricity of the inner satellite is very large, and this is the reverse of what would be expected if the diminution of its orbit had been occasioned by a resisting medium. The distance from its primary of the outer satellite is calculated at 12,500 miles; of the inner, 3,600, about as far as from Washington to Berlin.

THE SALT OF THE SEA.

Professor Hilgard described an optical ocean salinometer, for the determination of the saltness of the sea at different depths and localities. The new instrument resembles a spectroscope with telescope attached. The sea water to be examined is poured into a triangular bottle, which takes the place of the prism in the spectroscope. Light is admitted through a slit made by covering with black varnish all except a narrow space in a lens, and a lamp can be placed before this slit, all parts being practically secure against shaking by the motion of a ship. Professor Hilgard said that with this instrument a very regular scale of values had been attained.

Professor Alexander Agassiz gave a very interesting account of deep sea dredging in the Gulf of Mexico, and especially described

THE RECENT IMPROVEMENTS IN SOUNDING APPARATUS.

In sinking the lead to great depths, heavy weights are required. On the Challenger the only mode of ascertaining that the lead touched bottom was by noticing when the rope ran out more slowly than before. This operation was performed with a very heavy rope, such strength being necessary to hold the weights employed in sinking it. It was liable to an error of perhaps 300 fathoms in giving great depths. It is strange that the English did not use the invention of their own countryman, Sir William Thomson, instead of the antiquated sounding rope. The improvement principally consists in substituting a piano wire. This, after running out, leaves the shot, with which it is weighted, on the bottom. Repeated soundings with the piano wire on board the Blake indicated that the accuracy attained was within one-hundredth of one per cent; the Challenger soundings were only within five per cent. The time gained by using the wire is quite remarkable; for instance, twenty to twenty-five minutes as compared with two hours. The iron shot weight left on the bottom of the ocean is, perhaps, a sixth of that lost by the old process.

Professor Agassiz showed the dredge as now modified and used on the Blake. It embodied a method which did the sifting at the bottom instead of the top of the ocean. A rope was so fastened to the dredge that it no longer tended to bury itself. After this had been successfully tried, a further improvement was made by substituting a flat box for the dredge, with net sides; this ran smoothly along the bottom without burying at all. Tangles were attached behind the dredge which were of great service.

The trawl was another instrument needing improvement. Its tendency was to turn over sidewise, and then catch nothing. On the Blake no such difficulties were encountered; they used a contrivance somewhat like an oyster trawl, that had the merit of doing its work equally well whichever side was up.

The clumsy apparatus of the Challenger made its work costly. The total weight of dredge, rope, and shot in three miles' depth was three tons, and of course the rope wore rapidly under such a strain, and often parted while out. The British expedition lost 50,000 fathoms of such rope. The Blake expedition could not afford loss at a similar rate, even for a season's cruise, and it was determined to do for dredging what had been done for sounding—to substitute wire for rope. With wire, the dredge served sufficiently as a weight. The time saved by using wire with the dredge was as great proportionally as with the sounding lead. Hauls were made in two hours that would have consumed eight hours on the old plan, and five or six hauls were made per day instead of one. In three weeks one sixth as much was done as in the three or four years' work of the Challenger.

RESULTS OF THE CHALLENGER EXPEDITION.

The following observations are reported by Professor Agassiz: Where the depth is 1,800 to 2,000 fathoms inside the Windward Islands, the fauna corresponds to that of the Atlantic outside; the animals having doubtless penetrated through the openings between the islands. All classes of the animal kingdom found in the ocean are well represented. Inside the Caribbean Sea the fauna is more specialized and characteristic. On the Challenger expedition it had been ascertained that the red clay ooze of the ocean bottom was largely a result of the decomposition of the shells of surface animals—a disintegrated portion of the limestone contained in those shells. Everywhere in the Gulf a similar deposit was found. Pelagic animals, chiefly mollusks, may be said to fill this sea from the surface to 8, 10, or 25 fathoms in depth. The dredge always brings up a quantity of their half decomposed shells, and in instances where the test of proportion was carefully tried, it was found that more than half the mud consisted of shell fragments. There is no doubt that a stratum is forming at the bottom of the sea, due entirely to the coverings and hard parts of pelagic animals which exist in swarms near the surface. On the question as to the existence of many animals in deep water, near neither the surface nor the bottom, Professor Agassiz is inclined to distrust the Challenger observations. The apparatus there used could not furnish proof as to the point whether the animals

were really caught at the depth of 1,000 fathoms or near the surface. The fruits of the towing net may have been gathered anywhere in its course.

In the course of this expedition the temperatures of the Gulf Stream were ascertained throughout, from top to bottom, and through the whole area. The fact had been first noticed by Dr. Carpenter that an inclosed sea, such as the Mediterranean, may have a higher temperature for its depths than corresponding depths of the ocean. The difference in that instance is 35°. It is caused by the fact that the ocean water flowing into the Mediterranean has to cross a barrier at Gibraltar; the depth there is about 500 fathoms, and the temperature at that depth is that of the sea to the east of it, the cold water at the bottom of the Atlantic either never rising so as to float over that barrier, or, if it does, being warmed to the higher temperature while in transit. The Caribbean Sea is similarly inclosed by barriers, and its waters at their greatest depths are only as cold as that of the lowest soundings on the barriers. Similar observations are on record about the Soloo Sea and other bodies of water thus marked off by submarine or surface elevations surrounding them.

MEASURING STARLIGHT.

Professor Pickering has devised an instrument for the special purpose of comparing the components of double stars. The images are separated by a Nicoll's prism, and there are various contrivances for preventing error. A chart is in preparation at Harvard of all the double stars north of 40° latitude; at present this work is about half done, 90 stars having been finished and reported upon, requiring 4,000 observations. The probable error in this work is less than the tenth of a magnitude. A star in Cassiopeia gave a great deal of trouble; the discrepancy in the observations upon it amounted at times to half a magnitude; eventually a faint companion was discovered, which accounted for the changes. It was long suspected that Gamma Ceti's companion shines by reflected light. It was a matter of great interest, as no planet has yet been recognized outside of the solar system. The test is, of course, the polarization of light. After forty or fifty observations, the Gamma Ceti case was determined to be no exception to the general rule. A special research to obtain a quantitative estimate of the difference of light in colored double stars has yielded unexpectedly uniform figures from different observers, and shows that such stars yield abundant light, notwithstanding their color. The companion of Sirius is estimated to be of about the ninth magnitude. Investigations to ascertain whether its light is reflected or not are as yet uncompleted. The working of the double star photometer is very satisfactory.

ABRASIONS OF THE NORTHWEST COAST OF AMERICA.

A very long essay was read by Professor George Davidson on the abrasions of the northwest coast of America. It was chiefly occupied with a description of the appearance of the coast ranges and hills that face the Pacific from Mexico to Alaska. Viewed collectively, they present a series of flat topped rocks, hills, beaches, and plateaus; of terraces cut into such general shapes by an agency of wide application. The various admitted agencies for transforming the terrestrial surface were considered separately, and shown to be inadequate for this result. Professor Davidson ascribes it, in connection with the gradual elevation of the coast, to a great ice belt which followed the shore line and performed this gigantic sculpture.

THE SIZES OF MOLECULES.

Dr. Wolcott Gibbs discussed the question as to what allowance should be made for the molecules of a gas in calculating its contraction under pressure, the contraction applying probably to the spaces around each molecule, and not to the molecules themselves. Some of the results are very curious. If we assume that in hydrogen we have nothing to deal with but the molecular and intermolecular spaces, it will follow that in one entire meter of hydrogen, at a pressure of 0 and temperature of 4° C., the molecular volume amounts to 538·9 cubic centimeters. In other words, the molecules occupy 539 millionths of the whole space. Under a pressure of one atmosphere, a cubic meter of hydrogen contains 545 cubic centimeters of matter. The relation of nitrogen to hydrogen at the same temperature and pressure for the ratio of volumes of molecules is as follows: H divided by N is equal to 1 divided by 2·77; that is, the volume of the molecules of nitrogen in one cubic meter of the gas is 2·77 times as great as the volume occupied by the molecules of a similar quantity of hydrogen. In the latter gas at 4° and one atmosphere, the mean free path of the molecules is 458 times their individual diameters; in nitrogen, 167·4 times. The diameter of an atom of hydrogen is to be expressed in centimeters by 42 divided by 10 raised to the ninth power; an atom of nitrogen, 54, also divided by 10 raised to the ninth power. This is in striking accord with the results obtained through other lines of research. The mean distance of the centers of the molecules of hydrogen will be, in centimeters, 512 divided by 10 raised to the ninth power; nitrogen, 607 similarly divided. Finally, Boyle and Mariotte's law holds good (for certain limiting conditions of pressure), provided it be applied solely to the interstitial spaces and not to the molecular matter of gases.

Professor S. P. Langley called the attention of the Academy to the strange similarity between the A and B lines of the spectrum. The likeness of the A group of lines is so very marked as to indicate that they, too, are of telluric, not solar, origin.

Professor Henry communicated the closing address, mainly relative to the work of the Academy and the ground of selection of its members, which, he said, must be actual scientific labor in the way of original research; that is, positive addition to the sum of human knowledge; and this qualification of a candidate must be united with unimpeachable moral character. Not social position, popularity, extended authorship, or success as an instructor can entitle to membership; this is due alone to actual new discoveries: nor are these sufficient if the reputation of the candidate is in the slightest degree tainted with injustice or want of truth.

At the election of officers, Professor O. C. Marsh was elected Vice President and Professor J. H. C. Coffin, Home Secretary.

The meeting adjourned on April 19th.

Julius Robert von Mayer.

On the 20th ult. died Julius Robert von Mayer, of Heilbronn, in Würtemberg, a man whose labors in physical science have won for him an undying renown.

"The mechanical equivalent of heat" is an expression which was introduced into science by Mayer, who must always be regarded as having stood in the front rank of the founders of the dynamical theory of heat. In 1842, while practicing as a physician in his native town of Heilbronn, he published a paper in which the relations which subsist between heat and work were defined, and a computation of the mechanical equivalent of heat was given. With no means to make experimental research, he calculated the value of the mechanical equivalent, by the help of the best data procurable at the time, on the assumption that when a body is heated by compression the heat developed is the equivalent of the work expended in compressing the body. Subsequent researches have shown that this assumption is true in the case of air, the substance from the properties of which Mayer drew his conclusions. It is not surprising, however, that the value that he obtained for the mechanical equivalent of heat was far from being the true one, for in 1842 the specific heat of air at constant volume, and the ratio of the specific heats at constant volume and constant pressure, were very imperfectly known. Yet, when corrected in accordance with the results of more recent experiments, his calculation does not differ much from the value of the mechanical equivalent obtained by others by totally different processes. In 1845 appeared Mayer's paper on "Organic Movement in Connection with the Transformation of Matter"—a *brochure* of 100 pages—in which he speculates fearlessly and acutely on the agency of the so-called vital force, establishing the principles that all the so-called forces are interchangeable forms of energy—the one sole force; that energy is never created or destroyed, and that all natural phenomena are accompanied by a change of the form of energy. In 1848 was published one of his most notable papers, under the title of "Celestial Dynamics." In this paper he calculates the heat that would be developed by the collision of the earth with a target strong enough to stop its motion, and propounds the hypothesis that the sun's heat is maintained by the falling of innumerable meteorites on its surface. One point especially worthy of note in this paper is his statement of the effect of tidal friction in dissipating the energy of a planet's aërial rotation—an effect which was proved by Adams and Delaunay to exist in the case of the earth.

Mayer's last paper "On the Mechanical Equivalent of Heat" was published in 1851. It possesses the same fullness of original ideas as its predecessors, and in point of clearness of conception and definition can only be rivaled by Tyndall's "Heat as a Mode of Motion."

Soon after the publication of his last work his mind became affected in consequence of severe labors and disappointments he had suffered, and the rebuffs he had met with from scientific cotemporaries; and though at a later period he partially recovered, he was never able to resume his scientific investigations.

It must be claimed for Mayer that, in an obscure German town, without the means of making experiments, entirely isolated from scientific companionship, and with only the time that he could spare from his professional duties, he evolved in a remarkably short period a succession of theoretical views which, in point of originality, boldness, and comprehensive grasp of facts, stand among the foremost in the history of physics.

Auguste Lamy.

We have to record another loss to science in the death of the distinguished chemist, Professor Auguste Lamy, whose researches in organic and more especially inorganic chemistry have contributed not a little to the advancement of that branch of science. M. Lamy will be especially remembered for his isolation, examination, and description of the properties of the metal thallium; his results having been published at about the same time (1861) that Mr. Crookes announced the discovery of the new element. M. Le Verrier and M. Dumas endeavored at the time to claim for M. Lamy the discovery of thallium, and the claim was founded on a communication which the latter made to the Imperial Society of Sciences, Agriculture, and Arts, of Lille, May 16, 1862. The International Exhibition was opened on May 1, 1862, and there, in a case which had been opened some days before and arranged for the inspection of scientists, Mr. Crookes displayed several grains of the new metal and some of its compounds. Mr. Crookes had previously announced (March, 1861) the discovery of the new element, which he at first thought to be a member of the sulphur group. His specimen at the International Exhibition was in the form of a black powder. M. Lamy seems to have hit upon a more abundant source of the newly discovered element, and in June, 1862, he exhibited to a jury of chemists in London a beautiful ingot of the new metal. The discovery of Mr. Crookes, however, was deemed to have the priority, and the name that he had proposed for the metal was adopted. In 1864 M. Lamy described thallic alcohol, and in the following year published the results of his investigation of the phosphates of thallium. In 1869 Lamy invented the two valuable pyrometers associated with his name. In physics he studied the electric properties of sodium and potassium, and was the first to produce induction currents by means of terrestial magnetism. His death occurred on the 20th ult., at Paris, where for a number of years he had occupied the chair of Industrial Chemistry at the Ecole Centrale.

THE CAUSE OF BRICK INCRUSTATIONS.

We have before us two essays on the subject of incrustations on brick walls, one in the form of a report to the Philadelphia County Medical Society, by Joseph G. Richardson, M.D., the other an article in the *Journal of the Franklin Institute*, by Mr. William Trautwine, a well known engineer. Both papers will be found in full in our SUPPLEMENT of this week, and we allude to them here chiefly to point out the curious divergence of views between the physician and the engineer when the same subject is regarded by each from the standpoint of his respective profession.

Dr. Richardson thinks that the grayish white efflorescence is due to the sulphuric acid which comes from gas burners and coal stoves, being absorbed by moisture deposited during the evening upon the front walls of houses facing the east. The extremely dilute acid then combines with magnesia contained in the bricks, or possibly in the mortar, and when the water is evaporated by the morning sun crystallizes in the incrustation. He thinks that the latter has no injurious effect on health, but is rather evidence of the fixation of a deleterious product from coal and gas combustion, and hence it aids in producing pure air.

Mr. Trautwine points out that the coal with which bricks are burned contains diffused particles of iron pyrites, which are decomposed, yielding sulphurous acid gas. This acting at a high temperature, together with air moisture, upon the silicates of lime and magnesia already in the clay, the last are decomposed, and sulphates of lime and magnesia are formed, which impregnate the bricks. "When the bricks become wet these compounds dissolve, and in dry weather, succeeding storms, the solution evaporating from the surface of the bricks leaves them coated with the white compounds."

The reader is quite free to take his choice between these remarkably contrasting theories, which, while agreeing as to the nature of the incrustation, radically differ as to how it got there. It may be satisfactory to remember that there is no logical middle ground, and that if it did not come through outside causes, as advocated by Dr. Richardson, it must have come from the inside of the brick, as maintained by Mr. Trautwine.

Transparency of Metals.

That gold may be beaten to such a state of thinness as to readily transmit a greenish light is a fact that has been long known; and this property has been used by the gold beater as a practical test of the purity of the precious metal, inasmuch as the smallest admixture of silver with the latter causes a perceptible change of tint in the transmitted light. At a recent meeting of the New York Academy of Sciences, there was exhibited a film of gold (mounted between two plates of glass for protection against injury) which was stated to be the thinnest "leaf" of this metal that had as yet ever been produced. The method by which this remarkable result was obtained was very simple, yet one that required considerable delicacy of manipulation. An exceedingly tenuous film of gold having been, by means of a galvanic battery, deposited on the surface of an ordinary daguerreotype plate of copper, the latter metal was afterwards dissolved away by the action of nitric acid, and the gold film caught on a plate of glass.

The property of translucency, when in thin films, has until a comparatively short time ago been regarded as one peculiar to gold alone; the reason being, perhaps, that but few metals besides gold can be successfully hammered to the necessary degree of tenuity. In this respect, indeed, no metals but silver and platinum have been found to approach to gold. The interesting discovery has been made, however, that by means of electricity thin films, not only of gold but of the other metals, can be obtained which transmit light very readily. The method of obtaining these tenuous sheets of metal is by causing electric sparks to pass from wires of the required metals passing into tubes of rarefied air or other gases, when the particles of metal, detached from the wires by the sparks, become deposited on the sides of the glass, forming an excessively thin film, quite continuous under the microscope. Of the metallic films thus produced gold transmits a fine green light; silver gives a fine blue color; copper, a dull green; platinum, a bluish gray; zinc, a deep bluish gray; iron, a tint nearly neutral, but inclining to brownish; and cadmium, like zinc, a bluish gray.

MANGANESE IN THE BLOOD.—Richet has executed some quantitative determinations of this element by incinerating large quantities of blood, or destroying its organic constituents with chlorine, and then precipitating the manganese in the form of dioxide by the galvanic current. He regards its presence as accidental, not normal.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

THE FARMER'S AND MECHANIC'S MANUAL. By W. S. Courtney. Revised and Enlarged by Geo. E. Waring, Jr. Sold by Subscription. E. B. Treat, 805 Broadway, New York city.

Colonel Waring says that in hunting through libraries for books giving data for various simple problems relating to farm work, he found plenty of volumes which contained almost everything except just what he happened to want to know. Any one who has searched for every day mechanical data in mechanical text books will recognize that experience as his own, and feel a prepossession in favor of the present work, in which the author says he has endeavored to place an immense amount of just that kind of practical information which working farmers need ready at hand at all times. To particularize all that is embodied would take much more space than is here available. There are chapters on measures of all kinds, on hydraulics, on fuel, on fences, on the horse and other farm animals, on keeping accounts, strength of materials, drainage, mechanism, painting, building, and so on through a long, varied, and useful category. All descriptions are plain and simple, an excellent index is provided, and there are over six hundred illustrations.

THE ANEROID BAROMETER; ITS CONSTRUCTION AND USE. Price 50 cents. D. Van Nostrand, Publisher, 23 Murray St., New York.

A valuable little handbook compiled from several authoritative sources, and quite fully covering its subject. It forms No. 35 of Van Nostrand's Science Series.

WOODWARD'S DRAWING STUDIES. Price $6. Published by the American News Company.

An excellent collection of lithographed models prepared by competent artists and well suited for study in schools. All of the drawings are repeated in outline and shade so as to adapt them to all ages and all conditions of progress. The collection is well suited for the use of art students and schools.

Notes & Queries

S. C. A.—See pp. 241 and 284, vol. 37; and SUPPLEMENT, No. 49, p. 770.—A. H.—A coating of hydraulic cement will be the cheapest remedy to apply.—C. E. B.—The weight of the water must be added to the pressure on the lower gauge.—V. N.—See p. 299, vol. 37, answer No. 16.—B. E.—Your question is too general. The best distribution of the steam must be determined from a consideration of the size and character of the engine, the piston speed, and the steam pressure.—H. W.—Regarding bar magnets, see answer No. 16, p. 299, vol. 37. The question of infringement depends upon the mode of construction.—W. B.—A heating apparatus such as you describe could probably be fitted up by any good plumber.—F. S.—Consult Willard's "Practical Dairy Book" and Cowen's "Cook's Receipt Book."—L. H.—Send to any of the booksellers who advertise in the SCIENTIFIC AMERICAN, for circular.—G. F. W.—The information you desire has yet to be published, so far as we are aware.—A. D.—Probably any good carriage builder will furnish either the article or the plan.—E. N.—We see no difficulty in the proposed arrangement.—P. P., Jr.—There should be no difficulty with the boiler, and all the machinery will probably answer very well.—The correspondent writing from Charlestown, Mass., who forgot signature, will find the information desired in SCIENTIFIC AMERICAN of January 19, 1878, answer No. 37.—E. F. Y.—We incline to an affirmative answer to all your questions.—L. M. B.—See vol. 33, p. 339, for general instructions. There are some special forms in the market which are well spoken of.—W. B.—See p. 232 of SCIENTIFIC AMERICAN, April 13, 1878. It appears to us that there is no doubt as to the utility of the application of the telephone to diving and submarine work.—W. C. S.—It appears that you have obtained a result which is as good as is usually obtained with the instrument in its present form.—J. O'M.—It is a fact that coal exposed to the weather deteriorates to a considerable extent.—S. W. S.—It might be well to arrange the slats so that the sail would form a warped surface. See p. 241, vol. 32.—A. A.—The electric circuit through so many instruments has no doubt great resistance, and it may be necessary to use as many as 60 cells of Hill's battery to properly overcome it.—B. T. C.—We think you can suspend the zinc in the boiler without any injurious effect upon the water.

(1) P. E. L. asks: What are the best solutions for tempering mill picks? A. Most blacksmiths use clear water, but some add ½ lb. of salt per gallon of water.

(2) A. C. C. writes: I have been surveying and making maps of property, and cannot make the landmarks and compass bearings as laid down in the deeds agree with the present bearings. What is the variation or deviation of the compass for the past 25 years? A. You will probably have to obtain this information from old maps and deeds, and from the notebooks of former surveyors, if they are accessible. It often happens that in old deeds the bearings of lines are given, which lines are also referred to existing landmarks. A recent publication entitled "Magnetic Variation in America," by J. B. Stone, may possibly contain the information you require.

(3) L. G. S. writes: I wish to put a flagstaff made of wrought iron pipe on a building, say through the center of the roof. The telegraph wires are within 100 yards of the building. Would there be danger from lightning? A. It might be well to connect the iron flagstaff with the lightning rod.

(4) In answer to H. L. B.: Generally, if the fire is well covered, and the damper partly closed, the steam pressure does not rise. In regard to the scale, you may derive some benefit from the use of a filtering feed water heater.

(5) F. B. asks: 1. Will it do as well to have the valves of an air pump open in the side as upward (as in diagram)? A. The valves as shown will answer very well. 2. How large should the air chamber of a pump 1¼ inch bore and 3 inches stroke be, in order to raise water 6 or 7 feet in a ¾ inch tube? A. Make the capacity of air chamber at least as great as displacement of pump piston per stroke.

(6) J. T. asks: At what date was our present system of figures invented, and by whom was it first introduced? A. The Arabs, through whom the existing system reached Europe, are said to have obtained it from Hindostan in the 10th century. The date of the original invention and name of the inventor are not known.

(7) W. P. R. asks: Could a steel spring be made powerful enough when wound up to propel a boat 20 feet long? A. While we could hardly recommend such a means of propulsion, it is possible. The great difficulty will be in winding up the spring, as by increasing its width or providing several springs you can increase the power to almost any desired extent.

(8) C. E. H. writes: Please explain the way in which the following formulæ relating to steam vessels are used: $\frac{V^3 \times D^{\frac{2}{3}}}{\text{I. H. P.}}$ and $\frac{V^3 \times \text{mid. sec.}}{\text{I. H. P.}}$. A. The formulæ are used to compare the performance of different steamers, by substituting proper values for power, midship section, etc., and calculating the resulting constants.

(9) S. C. D.—The scarlet color appears to be coralline, a dye derived from phenol or carbolic acid. It costs about 90 cents an ounce. The violet compares well with Hofmann's "R," or methyl "RB."

(10) F. C. asks: How can I make an effective filter for muddy water? A. Conduct the water into the bottom of a large cask or hogshead half filled with washed silicious gravel, grading finer towards the top; then a thick layer of well burned, coarsely granular charcoal well covered with small gravel, thus nearly filling the vessel. Where a larger quantity of water is required than can be properly filtered in this manner, it is generally more satisfactory, within reasonable limits, to increase the number rather than the size of such filters. See also answer No. 39, SCIENTIFIC AMERICAN, p. 251, October 17, 1874.

(11) J. B. asks: What power engine and what size and pitch of screw will a boat 40 feet long and 13 feet beam require; boat to be used for fishing and hunting purposes, flat bottom, and as light draught as practicable? A. If a very light draught is needed, it may be well to use two screws, from 18 to 20 inches in diameter, and you can drive them both with a 7 x 9 engine.

(12) N. S. B. asks: How can I bleach a very fine Florida bathing sponge, without injuring it in any way? A. You may try soaking in sulphite of soda solution and subsequently washing thoroughly in water. See SUPPLEMENT, No. 38, p. 606.

(13) T. W. I. asks: How can I thin some very thick boiled linseed oil, for use in polishing wood? A. Mix spirits of turpentine with it.

What is the best color to temper fine drills to? A. A clear purple.

What is meant by the "pitch" of a screw propeller? A. The degree of twist in the blades, like the pitch of a screw thread.

How can I render light cotton cloth waterproof? A. Moisten the cloth, on the wrong side, first with a weak solution of isinglass, and, when dry, with an infusion of nut galls. Or use a solution of common bar soap instead of the isinglass, and another of alum in place of the galls.

Can I make a telephone of a short circuit without using a battery? A. See answer No. 19, p. 155, SCIENTIFIC AMERICAN, March 9, 1878.

(14) In answer to H. L.—Numerous experiments, by independent investigators, confirm the statement that the maximum density of water is reached at a temperature of about 39° Fah., so that expansion takes place whether the temperature is decreased or is raised above this point.

(15) T. S. asks: What is the formula for finding the horse power of a stationary engine? A. Find how many foot lbs. of work the engine performs in one minute, and divide this quantity by 33,000. The quotient is the horse power of the engine.

(16) I. P. H. asks: 1. What battery do you consider the best for plating and electrotyping for an amateur to use? A. Smee's, or some simple form of sulphate of copper battery. 2. What material do electrotypers use for making moulds for letter work? A. Beeswax.

(17) L. D. asks: How many cells of Bunsen's or Grove's batteries are required to produce an electric light capable of lighting a room 20 x 25 feet? A. About 20.

How can I make a telephone? A. See answer No. 19, p. 155, current volume.

Why are the zincs in a battery connected with the carbons, when there are more than one cell, and not the zinc to zinc? A. They may be connected in either way. If it is desired to produce an intense current of electricity, the pairs are connected in the first way you mention; but if a quantity current is desired, then all the zincs are connected as one zinc, and all the carbons as one carbon, and a wire joining the two will conduct a current of quantity electricity.

(18) O. B. M. writes; 1. I have constructed an acoustic telephone by taking two tin cylinders, each having one sheepskin head. A small hole is made in each head, and a string run from one to the other. I can hear distinctly 50 feet, but the string must not touch anything between. A. The string which joins the instruments may be stretched a long distance and around corners, if supported at each corner by a short piece of string fastened to a tree or post, or other convenient object. 2. If I take wire can I carry sound 500 yards by having it directly attached to the necks of bottles as telegraph wires are? A. Using the instruments you describe, most if not all of the sound vibration would be lost at the bottle neck supports.

(19) "Constant Reader."—Drawing is taught at all technical schools. Free instruction is given at the Cooper Institute in this city. The supply of ordinary draughtsmen is at present, we think, rather in excess of the demand. First class draughtsmen can generally find employment, at a good price.

(20) T. E. M. asks: Does the piston of a locomotive, when running, come back in the cylinder the same as in a stationary engine, or is its motion always forward? A. The piston moves backward and forward with reference to any point of the cylinder, while it may be continually moving forward with reference to some point on the ground.

(21) L. H. J. asks: Can clockwork, acting through the medium of a spring or the force of gravity, be considered as a prime mover or a transmitter? My friend contends that the elastic force of the spring and force of gravity on the weight are true forces of nature, and that therefore such clockwork is a prime mover from the definition of that term. I hold that it is merely a transmitter, because as much work has to be expended upon it as is given out. A. We think your view of the case is the correct one.

(22) T. P. F. asks: 1. Does the percentage of slip of a screw propeller with a boat having a fine run increase with the number of revolutions? A. With a well designed screw, there is not a great difference in slip for a considerable variation of speed. 2. What is the least amount of slip for the propeller of a steam yacht? A. From 7 to 8 per cent, we believe. 3. What is the greatest number of miles ever made in one hour by a 50 foot steam yacht without tide or current to help? A. There are no reliable records of continuous speed for such vessels higher than 20 or 21 miles an hour. Some of the new English steam torpedo boats are credited with a speed of 27 knots an hour, probably measured over a short course, and the distance per hour computed from the rate thus acquired.

(23) G. V. B. asks: What will prevent the steel parts of drawing instruments from rusting? A. Clean them occasionally with an oiled rag.

(24) L. S. T. writes: 1. In the early part of the winter I filled a small keg with cider that had been made in the fall. From this keg I filled a small glass bottle which was perfectly clean. They were both placed in the same cellar, the bottle being corked tight, and the keg having the bung out; at this time the cider in the keg is about the same as it was when put in, while that which was put in the bottle is a No. 1 vinegar with a very high color. What caused the cider in the bottle to make vinegar in such a short time? A. It was probably due to impurities from the bottle, cork, or funnel used in filling. 2. Is there anything injurious to vinegar about lead pipe, that is, if vinegar be run through the pipe? A. Vinegar quickly corrodes lead, forming soluble lead acetate (sugar of lead), which is very poisonous. 3. What would be the result if block tin pipe were used? A. Vinegar has little, if any, effect on pure block tin pipe.

(25) W. S. asks how to make gold lacquer. A. 1. Shellac, 3 ozs.; turmeric, 1 oz.; dragon's blood, ¼ oz.; alcohol, 1 pint. Digest for a week, with occasional stirring, decant and filter. 2. Digest in separate portions of wood naphtha or wine spirits an excess of turmeric and dragon's blood; dissolve shellac in 5 parts of alcohol or wood naphtha (methylic alcohol), and color with the above tinctures (filtered) to suit.

(26) M. H. T. & Co.—The sample sent us consists principally of a solution of resin and oil or resinous alumina soap in oil of turpentine and benzine or kerosene. Pale alcoholic shellac would doubtless answer as well. You may try also: 1. Gum caoutchouc dissolved in a mixture of carbon disulphide with six per cent of strongest alcohol. 2. An aluminous soap dissolved in turpentine oil. The latter dries quite slowly, the former rapidly at ordinary temperatures. The aluminous soap is prepared by adding to a dilute, boiling solution of common yellow (resin) soap, solution of aluminic sulphate (alum cake) as long as a precipitate forms; washing and drying the precipitate at 250° Fah., and dissolving it in warm oil of turpentine.

(27) R. C. asks: What is the method employed in testing the hardness of metals and alloys? A. If by hardness is meant the power of resisting abrasion, we do not know that there is a standard scale in use other than that of Mohs and Breithaup, usually employed by mineralogists. In this talc is taken as No. 1 and the diamond as No. 10; the intermediates being: 2, gypsum (cryst.); 3, calcspar (transparent variety); 4, fluorspar (cryst.); 5, apatite (transp.); 6, orthoclase (white, cleavable); 7, clear quartz; 8, topaz (transp.); 9, sapphire (cleavable). No. 3 is of about the hardness of pure copper; it scratches and is scratched by the latter. No. 7 is about as hard as file steel. Fine gold = 2·5 to 3. Silver has nearly the same hardness as gold. Zinc = 2. Lead = 1·5.

(28) A. F. asks: Can a magnet be made strong enough to lift a cubic foot of solid iron or steel from the ground, if the magnet be placed from 2 to 3 feet above? A. This would require a combination of about four U-shaped electro-magnets, each having a hollow iron core 6 inches in diameter and 30 inches long.

(29) F. M. M. writes: In your answer to the inquiry of G. F. F. in regard to premium offered by the State of New York for a steam canal boat that would not wash the banks, you stated that the premium had been awarded. Please state to whom the premium was awarded, amount of award paid, and on what device the award was made. A. Wm. Baxter received $35,000, David P. Dobbins $15,000, and Theodore Davis $5,000. You will find full accounts of the boats for which the awards were made in the Reports of the Commission appointed to investigate the subject.

(30) L. P. C. asks: 1. How many 2 quart cells of Daniell's battery will it require to give shocks? A. 100, unless an induction coil is used. 2. Will common wood charcoal answer for the carbon in a Bunsen cell? A. Not properly; it is too light. The gas coke, obtained from the retorts used in the manufacture of common illuminating gas, is the proper material for this purpose.

(31) A. W. writes: I wish to become a locomotive engineer, but have had no experience in that direction. What will be the best course for me to pursue? A. If you are a good mechanic, try to obtain a position as fireman, and work your way up. If you have no shop experience it would be well to acquire some before going on the road.

(32) "Wisconsin" writes: 1. I have a stationary engine having an 8 x 20 cylinder that was bored out in good shape 4 years ago, and fitted, as I supposed, with two springs or rings in the piston follower. The engine became less powerful all at once, and on examining the piston I found it was solid, with a groove in the face, evidently intended for common packing. It did good service for one year. I now use hemp packing, and it lasts two or three days only. What should be done? A. From your account we think it would be well to refit the piston, and either put in new rings act by their own elasticity, or add springs to the present ones. 2. Where should a blower for producing an artificial draught be attached, in the smoke stack or under the grates? A. It usually does not make a great deal of difference.

(33) K. K. writes: The ceiling of our cellar is very low, being only about a foot above the top of the furnace, and the draught pipe is between the ceiling and the top of the furnace. The ceiling is lath and plaster. We are afraid that it will take fire some time when the furnace is hot. What remedy is advisable? A. It would be well to interpose a screen of some uninflammable material; but, if the other arrangements would permit, it would be safer to excavate a space in the floor of the cellar of dimensions sufficient to accommodate the heater, and increase the interval between its top and the ceiling by at least 2 feet.

(34) J. C. B. writes: 1. In a recipe for a process of preparing gelatin plates for making stearine relief pictures, I am told to "mix about 3 drops to the 100 cb. m." Is that correct? A. Read 100 cubic centimeters. 2. What is the length of time required for drying the plate before exposure? A. An hour to an hour and a half suffices; but it is better to let it stand a day or more if possible. 3. How should the plate be washed after exposure? A. Use hot water, changing it several times if necessary.

(35) In answer to J. G.: A well built cistern, properly faced with genuine Portland cement, will hold water tight for years. The walls should be laid in cement and, unless quite thick and in a firm clayey soil, faced on the outside as well as inside with the cement. For small rain water cisterns the brick work is occasionally laid in a mixture of equal parts of red and white lead tempered with oil; such require no cement facing, and are very strong. The materials must be dry. Water from such a reservoir must not be used for drinking purposes or in preparing food.

(36) J. S. A. asks how to stain wood in various colors. A. Brown: Concentrated solution of potassium permanganate in water. Red: Boil ¼ lb. of logwood and ½ oz. of soda in a pint of water; apply hot, and then go over the work with strong aqueous solution of alum. Rose: Potassium iodide in 12 parts of water for first bath; as second, mercuric chloride (corrosive sublimate) in 40 parts of water. Indigo solutions give blue washes. Wood dipped in concentrated hot solution of copper sulphate, and then in solution of washing soda, becomes light blue. Verdigris dissolved in 4 parts of vinegar imparts a good green color to dry wood. Turmeric dissolved in wood naphtha produces a yellow wash. Aqua regia (nitro-muriatic acid), when diluted with 3 parts of water, though somewhat destructive, is often used on light woods for a strong yellow.

(37) F. P. H. asks: 1. What battery do you consider best for small electrotypes and also for silver plating? A. Either Daniell's or the gravity battery. 2. Can I make a solution of German silver in the same way as plain silver? A. Treat the German silver as you would treat the metal nickel in making a bath for nickel plating. 3. I have a small Daniell's battery and also a decomposition cell; the battery is composed of a strip of copper, a porous cup and jar. I have been making small electrotypes of copper. I have lately found that the strip of copper has increased in weight, so that now it is about three times as heavy as when I first commenced to use it. What is the cause, and how can it be avoided? A. The formation of metallic copper on the positive pole is a natural result of the proper action of this form of battery. When the electric circuit is closed the sulphuric acid of the sulphate of copper solution, with which the battery is charged, unites with the zinc, for which it has a superior affinity, and thus induces galvanic action, by which the copper of the sulphate of copper solution is deposited on the copper plate or positive pole of the battery. With the arrangement described, we do not know of any positive remedy.

(38) F. M. S. writes: I am constructing an electric bell to be used in connection with a telephone over a wire line about 500 feet in length, over which line I have not been able to obtain any answer by the use of an electro-magnet wound with 50 feet insulated wire, using 1 cell of a gravity battery. Which shall I increase, the magnet or battery power, or both; and how much shall I increase them to obtain a good stroke upon the bell? A. Use four 1 gallon cells of gravity battery, with the magnet that you have.

(39) W. R. asks: What will remove ink from law binding, yellow leather or morocco? A. Filtered solution of calcium hypochlorite in acetic acid.

(40) E. W. asks: 1. How can small castings be nickel plated? A. See SCIENTIFIC AMERICAN, June 30, 1877, p. 408; and April 6, 1878, p. 209. 2. How can I bronze the castings in case I fail to nickel plate them satisfactorily? A. Varnish the castings with clear shellac varnish, and before the varnish dries dust the castings with copper bronze powder.

(41) R. B. R. asks: What is the simplest and least expensive mode of rendering shingled roofs fire or water proof, or both, without causing the water collected from such roof to be injurious or unfit for drinking? A. We are inclined to think that this problem has never been fully solved.

(42) J. L. writes: I have heard that it is beneficial to persons troubled with rheumatism to place glass tumblers under the bedposts of the beds they sleep in. The theory is that the glasses prevent the electricity from escaping. Has the plan any merit? A. It can hardly do any harm; but we are somewhat skeptical in regard to the benefit.

(43) W. M. M. asks how to render light rowboats waterproof along the joints. A. Fill the spaces with (pure) white lead and linseed oil, mixed to a thick consistency, and allow time to dry and harden thoroughly before using the boat. White lead already mixed can be purchased in small tins. If the seams are wide, calk with oakum, driving it in solidly.

(44) F. W. D. asks: How many leaves of gold (such as used by bookbinders) would make a block 1 inch high, if firmly compacted? A. About 160,000.

(45) C. M. B.—The recipe referred to is not satisfactory; lampblack alone is not a suitable basis for blacking, and a large quantity of glycerin is likewise objectionable. The following recipe will probably give better results: Boneblack (best dried from sugar house filters), 30 lbs.; sulphuric acid (commercial oil of vitriol), 2 quarts; strong malt vinegar, 2 quarts; mix and digest; then add with constant stirring coarse brown sugar, 11 lbs.; molasses (average New Orleans), 30 lbs.; sperm oil, 2 gallons. The ingredients must be well commingled by trituration, and allowed to act upon each other for several days before using. If too dry, a little water may be added.

(46) J. C. M. asks: 1. How is dextrin made? A. Commercial dextrin, or "British gum," is obtained by heating dry potato starch to a temperature of 750° Fah., in sheet iron trays or revolving iron or copper drums, similar to those used in coffee roasting, whereby it is transformed into semi-transparent, brownish lumps, which are converted into a pale yellow powder by grinding between millstones. It is completely soluble in cold water, from which it may be precipitated by addition of excess of strong alcohol. 2. Is potato starch the best substance from which to prepare it? A. Potato starch is generally used, but starch from other sources will answer. 3. What are the best tests to ascertain its purity? A. Agitate briskly a few grains of the dextrin in a test tube with fifty times its weight of pure cold water; then set it aside for 10 minutes. Pure dextrin dissolves completely in cold water to a clear solution. If not all dissolved pour off the solution, add a little water to the residue, heat to boiling, let cool, and add a few drops of iodine water; a blue color indicates starch.

(47) J. W. S. writes: 1. If I should construct a battery on the following principles, would it be a success? Take a one gallon glazed crock, put inside a zinc cylinder as high as the crock (cylinder open at one side); then use for porous cup a common unglazed plant jar, used for house plants; have inside the latter a strip of copper; then use around the zinc a solution of salt and water, and with the copper a solution of blue vitriol. A. Yes. 2. For strength of current how would it compare with a Grove's cell? A. It would have about one fifth of the power of the Grove's cell. 3. How many Grove's cells combined, ordinary size, will it require to operate successfully an electric lamp, or a light with carbon points, to be used for purposes of illustration in experiments in electricity? A. From 30 to 50 cells, according to their condition, will give a good light. 4. In diluting acids for battery purposes, how much water do you use? A. About twelve parts of water to one part of acid. 5. How long does a solution of acid last in the Grove battery without renewing? A. About 48 hours, if the zincs of the battery are thoroughly amalgamated with mercury. 6. Which would you advise one to use for experimental purposes, considering expense and usefulness, Grove's or a bichromate battery? A. Grove's would perhaps be the most suitable for your purpose.

Please give a recipe for mending broken glassware. A. Heat the glass and rub the surfaces that are to be united with shellac.

(48) J. W. S. writes: I am building a small steam yacht. It is to draw only about 1 foot of water. I propose using a propeller 1 foot in diameter and 16 inches pitch, but to obtain 6 miles per hour I shall have to run the screw at about 400 revolutions per minute. Will it give good results running so fast? If not, can I use a larger screw and not have it wholly submerged? I do not want it to project below the bottom of the boat on account of running in shallow water. Or, can I increase the pitch without increasing the diameter? A. There is no objection to running the propeller at that speed. You can increase the pitch to 20 inches if desired.

(49) E. H. R. writes: I have an interest book which says that the relative divisor of 12 per cent is 3,000; of 10, 3,600; of 9, 4,000, etc. What is a relative divisor, and how obtained? A. It is the divisor to be used in obtaining the interest for one day, or $\frac{1}{360}$ of a year. Thus at 12 per cent the interest for one day is $\frac{1}{360}$ of $\frac{12}{100} = \frac{1}{3000}$.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. A. McK.—It is asbestos (amianthus), used extensively for boiler felting, fire proof paints, etc. See address of dealers in our advertising columns.—H. L. C.—Minerals not received.—J. W. K.—Principally impure amorphous silica, probably from the decomposition of a soluble alkaline silicate—as water-glass. Not of considerable value unless occurring in large deposits.—L. N.—The syenite contains much iron sulphide—not otherwise metalliferous.—J. E. H.—It contains lime, magnesia, alumina, and potassa, combined with organic acids.—J. K. M.—No. 1 is smithsonite (calamine)—native zinc carbonate—of some value. No. 2 (small specimen) noble or precious serpentine. No. 3 is magnesite—magnesium carbonate.—M. F. C.—It is lenticular iron ore—a variety of hematite.—A. M. K.—It is kaolin, of good quality, and if properly freed from gritty matters by washing, would be of value.—H. P.—We cannot judge of the coating from the small sample sent. A number of such varnishes have been patented.—O. B.—Earthy limonite—a poor iron ore.—W. E. W.—It is sulphide of iron—marcasite.—T. O'N.—The sample was too small to admit of positive tests. The powder appears to consist principally of a lime salt, probably the sulphate (plaster of Paris), a salt of zinc, and the powder of a root containing tannin.—W. E.—The igneous rock contains crystals of tourmaline and quartz, and a little chlorite.—A. R. Q.—The samples in the wooden box consist of a clay slate containing much iron sulphide, mica schist, and a ferruginous marl. They are not of value.—A. B. T.—The two light colored specimens are sandstone conglomerate containing mica schist and hornblende; the other is an argillaceous sandstone with seams of lime carbonate.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Cinders in the Eye. By W. S. N.
Locomotive Strokes. By J. A. H.
Aerial Navigation.
Liverpool Engineering Society. By W. B.
The Science of Life. By J. R. H.

LISTS AND SPECIFICATIONS OF PATENTS.

A circular issued from the Patent Office at Washington states that, the appropriation made by Congress for printing and binding having been exhausted, the publication of the *Official Gazette* (containing the lists of patents) has been suspended; and the printing of specifications has been stopped for the same reason, which will necessarily delay the regular issue of patents. We are therefore without our usual lists this week. It is believed that the suspension will only be temporary, as a deficiency bill is now pending before Congress. Whenever this appropriation shall become available, the work of printing and issuing the regular Patent Office documents will be resumed at once.

English Patents Issued to Americans.

March 26 to April 8, inclusive.

Aerial machine.—F. A. Lehmann *et al.*, Washington, D.C.
Baling hoops.—J. B. Gould, U. S. Consul at Birmingham, Eng.
Check valve trap.—G. Waring, Newport, R. I.
Gas lighter.—G. H. Kitchen *et al.*, Rye, N. Y.
Hot blast apparatus.—S. C. Salisbury, New York city.
Inhaling apparatus.—L. E. Felton *et al.*, Potsdam, N. Y.
Lamp.—R. S. Merrill, Boston, Mass.
Lawn mower.—W. J. Lloyd *et al.*, ——
Measure for liquids.—B. Fitts, Worcester, Mass.
Ordnance.—G. Paulding, Cold Spring, N. Y.
Railway truck.—E. R. Esmond, N. Y. city.
Reaper.—Wood Mowing and Reaping Mach. Co., Hoosick Falls, N. Y.
Refrigerator.—N. Wheeler, Bridgeport, Conn.
Regulating electric motors.—H. C. Spalding, Bloomfield, N. J.
Rollers for wringing machines.—G. P. Clark, Windsor Locks, Conn.
Spinning machinery.—J. W. Wattles, ——, Mass.
Steam, hydraulic, etc., press.—J. W. Hyatt, Newark, N.J.
Steam boiler.—B. T. Babbitt, N. Y. city.
Straw braid sewing machine.—M. P. Carpenter, New York city.
Tool sharpening machine.—A. K. Rider, Walden, N. Y.
Vapor burner.—F. A. Brown *et al.*, Newton, Mass.
Water meter.—C. C. Barton, Rochester, N. Y.
Waterproofing.—H. A. Clark, Boston, Mass.

THE

Scientific American.

The Most Popular Scientific Paper in the World.

THIRTY-THIRD YEAR.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 37 Park Row, New York.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

Can I Obtain a Patent?

This is the first inquiry that naturally occurs to every author or discoverer of a new idea or improvement. The quickest and best way to obtain a satisfactory answer, without expense, is to write to us (Munn & Co.), describing the invention, with a small sketch. All we need is to get the *idea*. Do not use pale ink. Be brief. Send stamps for postage. We will immediately answer and inform you whether or not your improvement is probably patentable; and if so, give you the necessary instructions for further procedure. Our long experience enables us to decide quickly. For this advice we make *no charge*. All persons who desire to consult us in regard to obtaining patents are cordially invited to do so. We shall be happy to see them in person at our office, or to advise them by letter. In all cases, they may expect from us a careful consideration of their plans, an honest opinion, and a prompt reply.

What Security Have I that my communication to Munn & Co. will be faithfully guarded and remain confidential?

Answer.—You have none except our well-known integrity in this respect, based upon a most extensive practice of thirty years' standing. Our clients are numbered by hundreds of thousands. They are to be found in every town and city in the Union. Please to make inquiry about us. Such a thing as the betrayal of a client's interests, when committed to our professional care, never has occurred, and is not likely to occur. All business and communications intrusted to us are kept *secret and confidential*.

Address MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, 37 Park Row, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

ASBESTOS

Liquid Paints, Roofing, Steam Pipe and Boiler Coverings, Steam Packing, Sheathing, Fire, Acid, and Waterproof Coatings, Cements, etc. Send for Samples, Illustrated Catalogues, Price Lists, etc.

H. W. JOHNS M'f'g Co.,
87 MAIDEN LANE, N. Y.

Parties wishing to introduce their manufactures into

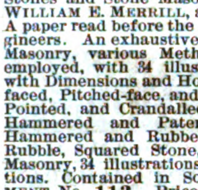
CANADA

please communicate with
R. H. BUCHANAN & CO.,
DOMINION MACHINERY DEPOT
654 Craig Street, Montreal.

JUST ISSUED.
Woollett's Old Homes Made New.

One Vol.; twenty-two 7x11 plates; price, prepaid, $1.50. Illustrated catalogue mailed on receipt of 3c. stamp.
A. J. BICKNELL & CO., Pubs., 27 Warren St., N. Y.

NOMENCLATURE OF BUILDING Stones and Stone Masonry. By J. JAMES R. CROES, WILLIAM E. MERRILL, and EDGAR B. VAN WINKLE. A paper read before the American Society of Civil Engineers. An exhaustive article on Stone Cutting and Masonry, various Methods of Dressing, and Tools employed, with 34 illustrations. 19 Tools, illustrated, with Dimensions and How to Make. Squared, Quarry-faced, Pitched-face, and Drafted Stones, Rubble, Cut, Pointed, and Crandalled Stones, etc. Axed or Pean Hammered and Patent Hammered Stones. Bush Hammered and Rubbed Stones. Diamond Panels. Rubble, Squared Stone, Range, Random, and Ashlar Masonry, 34 illustrations in all, with practical instructions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **113.** Price 10 cents. To be had at this office and of all newsdealers.



BURR MILLS.

For the best *Vertical* and *Horizontal* French Burr Grinding Mills, Portable Flouring Mills, and Mill Machinery, address the Manufacturer and Patentee,

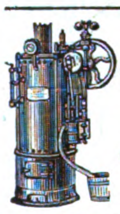
C. C. PHILLIPS,
4048 Girard Avenue,
PHILADELPHIA.

Something for your Boy! An Excelsior Portable Printing Press. Gives *pleasure* for spare hours, he earns his own pocket money printing cards, etc., and it is *safe* and *instructive*. Send 6c. for catalogue.
KELSEY & CO., M'f'rs, Meriden, Conn.

North's Pat. Universal Lathe Dog
Is always in nearly perfect balance. Always stands up square with the work, and will not "skew."

SELDEN G. NORTH, 347 No. 4th St., Phila., Pa.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.



Domestic Semi-Portable Engine,
2 and 4 horse power, and
The Peerless Portable Steam Engine,
for Agricultural and other purposes, from 6 to 10 horse power.

Nothing cheap but the price. Send for descriptive catalogue and price list to

F. F. & A. B. LANDIS, M'f'rs,
Cherry St., Lancaster, Pa.

JAPANESE ART MANUFACTURES. By Christopher Dresser, Ph.D., etc. Paper read before Society of Arts. The Japanese Potter at Work. Curious mode of Making Scarfs. How the Japanese Print on Cloth. Japanese Process for Silk Ornamentation. Japanese Weaving. How Fine Japanese Fans are made. Japanese Method of Making Moulds for Ornamental Castings for Vessels, Bronzes, etc. Japanese Lacquer Manufacture. Curious Method of Decorating Lacquer Work. The Love and Pursuit of the Beautiful in Japan. A very entertaining, instructive, and comprehensive paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **115.** Price 10 cents. To be had at this office and of all newsdealers.

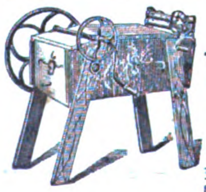
Bound Volumes
OF THE
Scientific American.

At present, I have on hand the following **bound** Volumes of the SCIENTIFIC AMERICAN, which I will sell at $1.00 each, either singly or by the quantity.

OLD SERIES.	NEW SERIES.	NEW SERIES.
Vol. 7....3 Copies.	Vol. 1... 5 Copies.	Vol. 15.. 7 Copies.
" 11....5 "	" 2... 6 "	" 16.. 8 "
" 13....4 "	" 3... 3 "	" 28.. 8 "
" 14....1 "	" 4... 6 "	" 32..16 "
	" 8... 3 "	
Vols. of the Old Series contain one year's numbers, and the New Series six months.	" 10... 9 "	
	" 11... 2 "	
	" 12... 9 "	
	" 13... 9 "	
	" 14... 7 "	

The books will be sent by express on receipt of price. Address all communications to

JOHN EDWARDS,
P. O. Box 773, New York.



CLIMAX Washing Machine,

Manufactured by
N. C. BAUGHMAN & CO.,
YORK, PA.
Reliable agents wanted. Descriptive circulars furnished.

ESTABLISHED 1844.
JOSEPH C. TODD,

(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. I also manufacture Baxter's New Portable Engine of 1877, of one horse power, complete for $125; can be seen in operation at my store. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address

J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

PUNCHING PRESSES. DROP HAMMERS AND DIES, F[illegible] working Metals, &c.
The STILES & PARKER PRES[illegible]
Middletown, Conn.

UPRIGHT DRILLS [illegible]OR [illegible]LAR
H. BICKFORD Cinc[illegible]ati O.

CAMERON Steam Pumps

For Mines, Blast Furnaces, Rolling Mills, Oil Refineries, Boiler Feeders, &c.

For Illustrated Catalogue and *Reduced* Price List send to **Works, Foot East 23d St., New York.**

An assortment of
WOOD-WORKING MACHINERY
made by Richards, London & Kelley (dissolved); also, a number of first-class MACHINE TOOLS (nearly as good as new) of Philadelphia construction, on hand and for sale. For list or inspection of machines and estimates, apply at the works of JOHN RICHARDS & CO., 22d and Wood Sts., Philadelphia, manufacturers of Standard Gauges and other Implements.

FRIEDMANN'S PATENT
INJECTORS and EJECTORS
Are the Most Reliable and Economical
BOILER FEEDERS
And Water Conveyors
IN EXISTENCE.
MANUFACTURED EXCLUSIVELY BY
NATHAN & DREYFUS,
NEW YORK.
Also Patent Oilers and Lubricators.
Send for Catalogue.

Cut Brass Gears, list free. Grant, 94 Beverly St., Boston.

PORTLAND CEMENT,

ROMAN & KEENE'S. For Walks, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc. Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & Co., 53 Broadway, New York.

TURBINE WATER WHEELS.

New pattern. Increased percentage of power given. Estimates given on all kinds of Mill Machinery.
O. J. BOLLINGER, York, Penn.

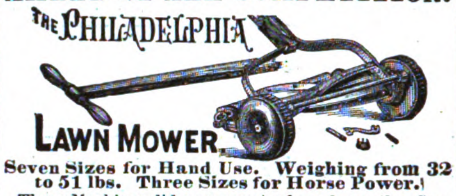
LACKERS' VARNISHES, WHITE SHELLAC.
W. ZINSSER & CO., 197 William St., N. Y.
MANUFACTURERS' SUPPLY STORE.
Agents for U. S. Salicylic Acid Works.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

TO ADVERTISERS! We will send free to all applicants who do any newspaper advertising, the THIRD EDITION of
AYER & SON'S MANUAL FOR ADVERTISERS. 160 8vo.pp. More complete than any which have preceded it. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists have been carefully revised, and where practicable prices have been reduced. The special offers are numerous and unusually advantageous. Be sure to send for it before spending any money in newspaper advertising. Address **N. W. AYER & SON,** ADVERTISING AGENTS, Times Building, Philadelphia.

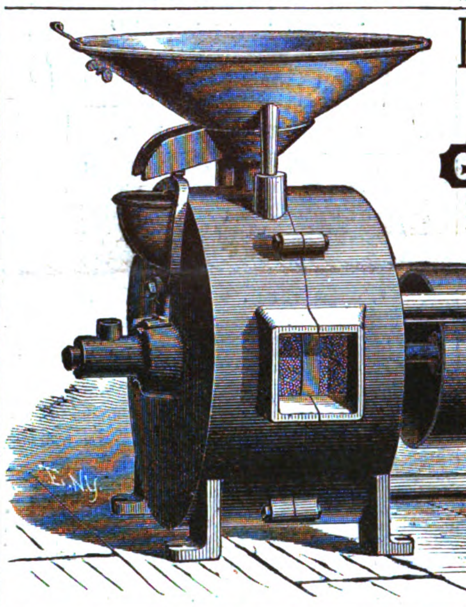
AHEAD OF ALL COMPETITION.

THE PHILADELPHIA LAWN MOWER.



Seven Sizes for Hand Use. Weighing from 32 to 51 lbs. Three Sizes for Horse Power.

These Machines did an amount of work on the Centennial Grounds equal to 10 years of ordinary use, without loss of time for sharpening or repairs—completely distancing all competitors in the celebrated trial of 6 months duration. GRAHAM, EMLEN & PASSMORE, Patentees and Manufacturers, 631 Market St., Phila., Pa.



Harrison's Newly Improved
LIGHT STANDARD 20 INCH
Grinding Mill
Made at New Haven, Conn.

Grinding Capacity per hour,
6 to 40 Bushels.
Send for Illust'ed Catalogue.
Address
W. A. Foskett,
Administrator.

PATENT
COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by
FULLER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

THE TELEPHONE. BY R. M. FERGUSON, F.R.S. Read before the Royal Scottish Society of Arts. Its Construction, Uses, and Working fully and philosophically explained, with four illustrations. History of the Telephone. The Reis Telephone. Bell's. Wonderful sensitiveness. Difference between the Galvanic and the Telephonic Impulse. A curious experiment. Theory of the Telephone. Molecular Vibrations of Metals. Magnetic Musical Sounds. Cause of the Sound. New Form of Telephone. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **120.** Price 10 cents. To be had at this office and of all newsdealers. Also, in the same number, a Visit to the Inventor of the Phonograph. The Practical Uses of the Instrument in Cheaply reproducing Music. How the voice of the Prima Donna and the Elocutionist may be multiplied and preserved to all time. Usefulness of the Phonograph to the Blind, to Advocates, and others. Price of the Phonograph. An Improved Form, etc.

RISDON'S IMPROVED
TURBINE WATER WHEEL

Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

WATSONS NON CHANGEABLE GAP LATHE HAS STEEL WORK. JAMES WATSON GREAT FACILITIES FOR LARGE OR MEDIUM MANUF 1608 S. FRONT ST. PHILA

ICE AT $1.00 PER TON.
The PICTET ARTIFICIAL ICE CO.,
LIMITED.
Room 51, Coal and Iron Exchange, P. O. Box 3083, N. Y.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

UNIFORM SPEED THE MOST PERFECT STEAM GOVERNOR IN THE WORLD. *However great or violent may be the change of load, We will warrant any positive uniform SPEED of Engine desired.* Address HUNTOON GOVERNOR Co. LAWRENCE MASS

THE GEOLOGICAL ANTIQUITY OF Flowers and Insects. By J. E. TAYLOR, F.G.S. A plain, comprehensive review of the subject, bringing forward many instructive facts; with six illustrations. The invariable correlation between insects and flowers. How they are fossilized. Fossil botany. Geological Evidences of Evolution. Correspondence in the succession of Animal and Vegetable life. Flowers necessary to Insects, and Insects necessary to Flowers Insects and Plants in the Devonian, the Switzerland Lias, the English Stonesfield Slate, the Tertiary Strata, the Coal Measures, a Greenland, and other formations. A Peculiar Aspect of Evolution. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **120.** Price 10 cents. To be had at this office and of all newsdealers.

THE
Eclipse Engine

Furnishes steam power for all *Agricultural* purposes, *Driving Saw Mills,* and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial, '76. Refer to No. 7, issue of '77, No. 14, issue of '78 of SCIENTIFIC AMERICAN for Editorial illustrations.

BELT PULLEY,

Lightest, strongest, and best made. Secured to the Shaft without Keys, Set Screws, Bolts or Pins; also, *Adjustable Dead Pulleys* and *Taper-Sleeve Couplings.* Send for catalogue. Address Taper-Sleeve Pulley Works, Erie, Pa.

THE TANITE CO.
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS
GEO. PLACE, 121 Chambers St., New York Agent.

ROCK DRILLING MACHINES AND AIR COMPRESSORS.
MANUFACTURED BY BURLEIGH ROCK DRILL Co.
SEND FOR PAMPHLET. FITCHBURG MASS.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29. ST. NEW YORK CITY

MACHINISTS' TOOLS
Best quality at low prices. Radial Drills, Engine Lathes, Iron Planers, Car Wheel Borers, Hydrostatic Presses, Axle Lathes.
NILES TOOL WORKS, Hamilton, Ohio.

H. R. WORTHINGTON,
239 BROADWAY, NEW YORK.
Hydraulic Works, Van Brunt Street, Brooklyn. Manufactures Pumping Engines for Water Works. In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1st, 1877.

WOODWORTH SURFACE PLANERS, $125. Planers and Matchers, $350. S. C. HILLS, 78 Chambers Street, New York.

CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge,* a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.